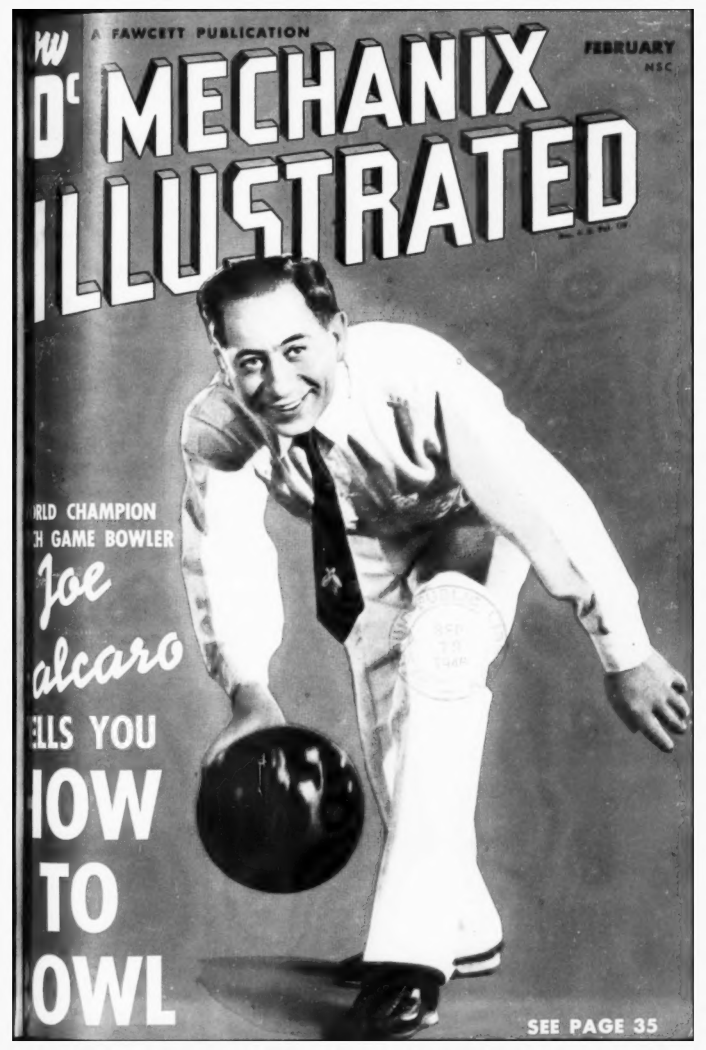
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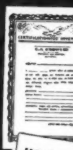

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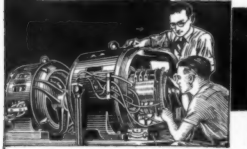

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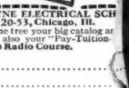

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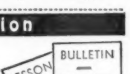

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- ☐ Electrical Engineering
- ☐ Diesel Engineering
- ☐ Drafting and Designing
- ☐ Electric Refrigeration
- ☐ Heating, Ventilating, Plumbing
- ☐ Professional Accounting Incl. C. P. A. Coaching
- ☐ High School
- ☐ Highway Engineering
- ☐ Law
- ☐ Liberal Arts (College)
- ☐ Mechanical Engineering
- ☐ Merchandising
- ☐ Private Secretary
- ☐ Radio and Television
- ☐ Salesmanship
- ☐ Shop Practice
- ☐ Shop Management
- ☐ Steam Engineering

Name..... Age..... Occupation.....

Street..... City..... State.....

Chips from the Editor's Workbench

Send in photos of your completed workshop projects. Each month MECHANIX ILLUSTRATED awards a first prize of $5 for the best photo and letter received by this department and prizes of $3 each for all other photos and letters used. Do not send negatives. Have copies of your photos made before you submit them, as NO PHOTOS WILL BE RETURNED.

"Your Job"

YOUR editor was gratified to read some wise advice to young men recently offered by William S. Knudsen, president of General Motors. His advice took the form of what he would do if he were a young man under thirty and not yet settled in his life's work. He said, "I would apprentice myself to a mechanic or plumber," and he went on to advise youths to work with their hands, to learn how to make things, even though they might be college graduates. Knudsen should know. He rose from the position of mechanic to the presidency of the largest automobile manufacturing company in the world.

You see, we feel the same as does Mr. Knudsen and that is why we are publishing the series "Your Job," the second article of which appears in this month's MI.

The purpose of the series is, of course, to enable youths and adult men with mechanical interests or inclinations to select a trade or business that fits them, that will make them happy, and that will pay the biggest possible financial return for their investment of energy and ability.

If we could afford it, we would advertise this series everywhere, over the radio, in the newspapers. One of our associate editors even wanted to hire an airplane and tour the country with skywriting equipment, flashing an advertisement for the "Your Job" series over every town and city.

Too bad we can't give the series the advertising it deserves, but you can help us advertise it, if you will. Tell your friends about it, and be sure yourself to read and file each article as it appears. When the series is finished we will have presented the important facts about every mechanical trade. As far as we have been able to learn, no extensive investigation of these trades and their possibilities for the individual has ever before been published. You can't get these facts at your public library or from any other source, but you can get them from MI.

Let us know how you like the series. Some of you have already written valuable letters containing pertinent suggestions, and we are paying particular attention to requests for articles on specific trades.

Quite a few persons, mostly teachers and parents, have written in for extra copies of the January issue, which featured the trade of auto mechanic. We are glad to supply these as long as copies are available, at 10c each, postage paid. Send your requests to Circulation Department, Fawcett Publications, Inc., Greenwich, Conn. However, send all comments and suggestions

[*Continued on page* 16]

The Warner Brothers cameraman goes aloft to take air views of La Guardia Field, New York, for a MECHANIX ILLUSTRATED-Vitaphone movie "short". (Look for it at your local theatre!) The big color camera was mounted just behind the pilot's compartment of a giant American Airlines transport, and recorded every activity of the busy fliers as they took the ship up for a flight over the airport. These pretty student-hostesses were interested observers.

THESE FREE BOOKS ARE FOR INVENTORS

AND OTHER MEN WITH IDEAS

"We're only entering the great period of inventive advancement"

—says C. F. Kettering, Vice-Pres., General Motors

SOMETIMES we hear people say: "Well, there isn't much left to invent." But Charles F. Kettering, Vice-Pres. and head of Research of General Motors, who helped develop the self-starter, Duco and many other outstanding inventions, **doesn't think that at all.** Not long ago in a published statement, he said:

"If we took half the men employed in tool making and put them to working out new inventions, new things, we could snap out of this depression in no time. Our return to normal times depends on new manufactured products that will catch the purchaser's eye, get him to buy and thus start the ball rolling. Change and buying go together. *We are only entering the great period of inventive advancement.*"

Many Little Ideas Have Big Commercial Possibilities

Some of the world's best inventions came from men who didn't consider themselves inventors at all. The telegraph was invented by a painter, the typewriter by a farmer, the hand camera by a tinsmith, the stock ticker by a dentist. Or look at small inventions. A husband noticed his wife bending a hair pin to make it stay put. That gave him the idea of the crinkly hair pin. One day a golfer got the idea to make a wooden tee. Now wooden tees are sold by the millions every year. There are many similar examples in inventive history. That is why we say that the books shown here are for INVENTORS and Other Men with IDEAS. Whether you consider yourself an inventor or not—if you have an idea that will make money, save time, save labor, or give pleasure—find out how you can protect your rights to it.

Our Business Is To Help You

For forty-two years, this organization has been in the business of helping inventors. During that time inventions from every corner of the country have been turned over to us to protect. Some ideas have represented complicated mechanisms; others have been small, practical articles, like a can opener or a new toy. All this has given us a wealth of experience to use for the inventor of today. Here in Washington, we maintain a large staff of experienced Patent Specialists to give you prompt and expert service. Yet because we work efficiently—our fees are low, and if desired we help you with deferred payments. But first, find out exactly what to do to protect yourself. **Decide on that today by sending for your FREE copies of the books shown above.**

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Editor's Workbench Chips

[*Continued from page 14*]

A $5 check is winging its way to Henry Bachman of Emmaus, Pa., for the tri-cycle motor scooter he built. One rear wheel is for braking and the other is the drive wheel, while the pair combine to balance the machine. Bachman's scooter will go 30 miles an hour in high speed and will travel about 70 miles on a gallon of gas. He uses a belt drive with a clutch so he can stop at red lights without shutting off his motor. Bachman, who is a student at Penn State, ought to find this nifty little scooter a handy means of getting from class to class.

about the "Your Job" series itself to me at the MECHANIX ILLUSTRATED Editorial Offices, 1501 Broadway, N. Y.

***

Seeing Is Believing

"Do readers of your magazine really build all those gadgets described in it, or do you run the articles just because the plans look attractive?" This question . . . I might say challenge . . . was thrown at me recently by a visitor. So I gathered a big armful of letters from the file, spread them over a desk, and invited him to see for himself. After ten minutes of silent reading, punctuated only by mutters and exclamations of surprise, he excused himself.

"I never realized before the extent of this home-shop activity," he said.

Before putting the letters away, we decided to study a representative batch of them closely. We obtained some interesting facts, and I'm sure you like to read them.

Nothing is too big or complicated for MI readers! Name anything that a man can make with his hands and it's on the list: boats, in all sizes

[*Continued on page 18*]

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Editor's Workbench Chips

[*Continued from page* 16]

from 4-foot lake skiffs to ocean-going ketches; model airplanes, from rubber-band babies to gas-engine jobs almost big enough to fly their owners; radio receivers and transmitters that talk around the world; powered bikes, motor scooters and midget automobiles; tractors and labor-saving farm machines of many kinds; *everything* connected with photography, including even cameras; furniture for every room of the house; model railroad systems; reflecting telescopes; doll houses; and so on no end.

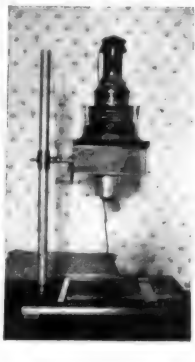
One of the big surprises was the age of the shop cranks. The general impression is that only 'teen age boys build model airplanes or stay up nights with short-wave radios. If they stay up with anything, it's usually their girl friends! As hobbyists, they're far outnumbered by married men, who have jobs and homes (and money!) and use their children as excuses for their cellar shop activities. Letters like this are received in almost identical form from readers all over the country:

"Enclosed find pictures of a sidewalk runabout I built from your plans for my eight-year-old son. It is powered by a half-horse engine and does 20 miles per hour."

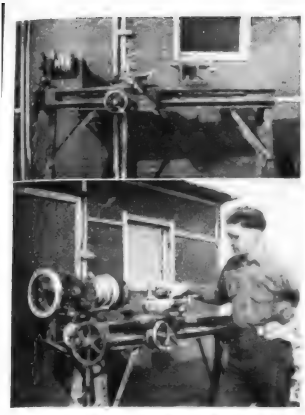
Imagine little Junior chugging down the street in a one-lung gas chariot while the local cop looks on beamingly! Pop just won't admit he built the car because he had a lot of fun doing so.

Workshop enthusiasts are everywhere! You're very wrong if you think shops are found only in the cellars of suburban homes. Some of the most elaborate projects we've seen were hand-crafted by apartment dwellers whose entire tool collection fits into an overnight bag and whose work-

[*Continued on page* 19]



"We're jealous!" write the Misses Lorene Stamm and Mildred Benner of good old Louisville, Kentucky, suh! "Three boy friends of ours all won prizes before we thought of sending in a picture of the enlarger we constructed from plans in March, 1938 MI. We have been using it since last summer and it works perfectly." So to keep the girls from being jealous, we are sending them a $3 prize for a very nice enlarger. The boys are the ones who should be jealous of your workmanship, girls!



Up in Spiritwood, Saskatchewan, there is joy in the heart of Gerard Fontaine because of the $3 prize he received for the above photos of his home built lathe. He used parts from cars, tractors, sewing machines, washing machines and threshing machines, as well as scrap iron and aluminum. Total cost of the job was $15. The tool has all the features of a modern back geared, screw cutting lathe.

bench is the kitchen table. We've received pictures of excellent shops built into clothes closets; an old dresser revamped to hold a small lathe; a spare bathroom converted into a darkroom.

Are power tools in wide use? I'll say they are! And their owners are by no means what you'd call rich or well-to-do. Cellar shops that look like a corner of the Ford factory are owned by bus drivers, elevator operators and cooks. How do they do it? By careful saving and sheer determination. Many a hobbyist will lunch for months on coffee and cigarettes and buy a long-coveted tool with the money thus saved.

I offer the following as my definition of a shop crank: A man who owns a lathe, a scroll saw and a drill press, and walks to the station each morning to save bus fare. More power to him!

***

We're in the Movies Now

We are highly gratified by the many complimentary letters readers send us after they have seen one of the MECHANIX ILLUSTRATED-Vitaphone movie shorts. Photographed in color and produced by Warner Brothers, under the direction of Ira Genet, these films are widely welcomed as interesting, educational, and entertaining. A huge amount of effort goes into them,

[*Continued on page 20*]

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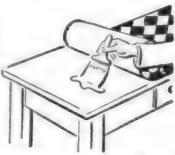

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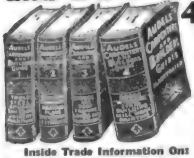

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Editor's Workbench Chips

[*Continued from page* 19]

This model cabin cruiser cops an award of $3 for Boyd Small of Vincennes, Ind. It is 36 inches long and constructed of balsa wood. No nails were used, all parts being held together with pins and glue. A motor run by four 1½-volt battery cells wired in a series drives a 1¼-inch propeller. The boat has a speed of about five miles an hour.

and Mr. Genet and his untiring camera crew go everywhere in their search for lively subjects. For instance, to get some air shots of New York's giant new airport, La Guardia Field, they went aloft in a giant American Airlines 21-passenger "Flagship" (see picture on page 14), and spent almost a full day getting some thrilling scenes that will take about 50 seconds screen time!

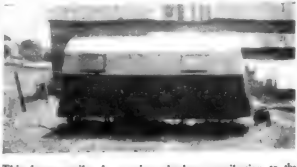
If your local movie house hasn't yet booked the MECHANIX ILLUSTRATED-Vitaphone shorts, drop us a card with the name and address of the theatre and we'll see what can be done about it.

•••

Bang! Bang!

The present European war proves the danger of prediction. Before it started, everyone believed that the German air force was invincible and would rain death and destruction on Paris and

[*Continued on page* 21]



This house trailer is a prize winning contribution to the Workbench of Howard Keas of Dyer, Tennessee. The trailer, which is 16 feet long and weighs 1,500 pounds, has electric lights, a davenport, a small kitchen cabinet, a clothes closet, a dinette and chairs, and small cabinets all around the edge of the ceiling. The top is covered with canvas and painted silver and the sides are made of used tin. It looks like a mighty comfortable house on wheels in which to tour the country.

Remember the water skiis described in the September, 1939 issue of MI? Theodore Stack, of Cohoes, N. Y., followed the plans exactly, and even posed these pictures of himself to resemble the ones published with the article. Why not build a pair of these skiis for yourself, for water fun this summer? Do the work now, while the cold weather keeps you indoors, and have them ready for the first warm spell.

Berlin; that Great Britain's powerful navy would rule the seas; that Russia's long-famed "parachute army" would drop behind its enemy's lines and raise havoc there.

And what's actually happened? All the scientific experts were wrong! French pilots, flying half-obsolete American-built Curtiss pursuit planes, have swept the much-overrated German Messerschmidts from the skies. Even the British, with ships that still use wooden propellers, have repulsed one air raid after another. Meanwhile, their proud navy has suffered severe damage from puny German submarines and "magnetic mines," the latter a 1916 idea that everyone else forgot about completely. The Russians pull their silly parachute trick on the fighting Finns and promptly get themselves wiped out.

Some of those master-mind generals and admirals should read MI occasionally and get some real ideas from our artists' drawings!

***

For Modellers

A new book which should be of great interest to boat enthusiasts in general and sailing-ship model builders in particular is "Square Riggers Before The Wind"* by Capt. Josiah Grundy and Wilkins W. Wheatly, the latter a frequent contributor to our how-to-build section. The book tackles the subject of sailing ships and the building of models thereof from an entirely fresh and original angle, treating them as things of living beauty rather than relics of the past. About half its pages are devoted to the history of boats under sail and interesting accounts of typical voyages. This leads up to the second portion of the book, dealing with the construction of simplified scenic *action* models of full-rigged ships. The method of building these models was developed by Capt. Grundy, and they

**E. P. Dutton & Co., Inc., New York, N. Y., $3.00*

[*Continued on page 22*]

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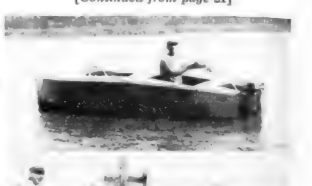
Editor's Workbench Chips

[*Continued from page 21*]



Roy Gresens of Rochester, N. Y., wins a $3 prize for his version of MI's *Buzzer II*, which differs slightly from the original, for instead of using planking on sides and bottom, Gresens used a waterproof plywood. A Lockwood nine-horsepower engine pushes the craft along at a speed of from 20 to 25 miles an hour. Total cost of building was $23.50.

are about the most realistic we have seen, depicting as they do ships actually under sail, as contrasted to the usual static mantel model. Profusely illustrated, the book includes a glossary and two large plan sheets inserted in a pocket in the back.

***

The "Boat Book" Is Out!

The month of January is notable in boating circles for two reasons: the annual Motor Boat Show is held then in New York, and the new issue of HOW TO BUILD 20 BOATS appears at the same time. The fifth edition of this famous book is now on sale, and if you'll forgive us for saying so, it's pretty darn good. Increases in paper and printing costs notwithstanding, the price is still 50 cents a copy, and that buys 144 pages just bursting with plans and ideas. Run, do not walk, to the nearest newsstand.

***

A Little Reminder

It's always nice to have readers express themselves freely on various matters of mutual interest. Please feel free to write to us at any time, but please remember to include one little detail: your name and address! Many readers probably think our offer of a blueprint catalog, for instance, is a fake, because they wrote in and never received their copies. Their letters are probably in our "morgue," because they forgot to sign their names or give their addresses. And sometimes the addresses that are given are incorrect, and then large packages of blueprints roam around for weeks before the post office finally returns them to us, battered and broken, with the notation, "Addressee Unknown."

—*Robert Hertzberg, Editor.*

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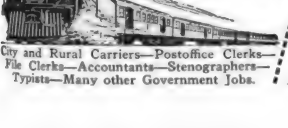

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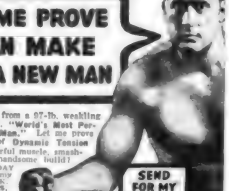

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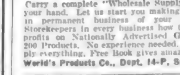

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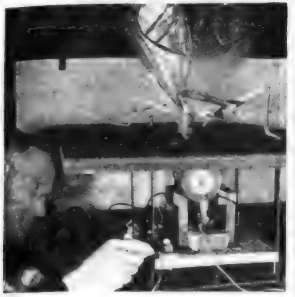

Natural history museums are gradually changing over many of their silent exhibits to talkies.

The rattle of a Red Diamond rattlesnake in the San Diego Museum of Natural History sends cold shivers down the backs of susceptible visitors who operate a prominently displayed switch. The clapper of a door-bell inserted in the tail shakes it and produces a realistic rattle.

A large scale cricket in the same museum emits its familiar chirping sound as its wing edges rub together, just as in nature. The sound in this case, however, is produced by spacing electrical contacts on a wheel that revolves in synchronization with the wing movement, causing a buzzer on a special sounding board to operate.

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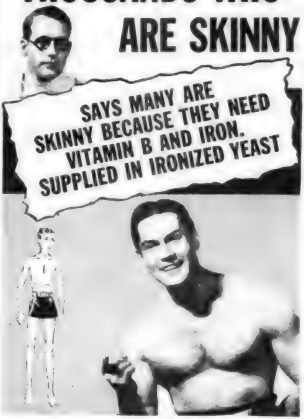
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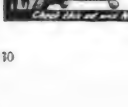

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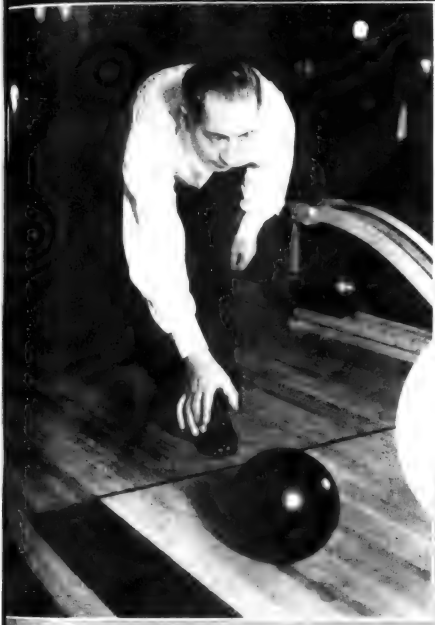
Vol. XXIII
No. 4

February
1940



With over twelve million men, women and children enjoying bowling, it ranks at the top among America's favorite indoor sports. In this article, Joe Falcaro, the world's greatest bowler, gives expert advice to both beginners and "old hands" on the best way to become a first class bowler.

HOW TO BOWL

by
Joe Falcaro

I HAVE, through personal instruction, made thousands of good bowlers from beginners. Too, I have made hundreds of excellent bowlers, men who average around 200, from good bowlers.

Any bowling secrets I have been able to reveal to these bowlers you will find on these pages. I urge that you read this article several times, slowly and carefully, so that no point is missed. Study it as you might study a lesson in school. Memorize it, if necessary, but be sure you understand and apply every point in practice.

This advice goes to those of you who may have been bowling for five or ten years, as well as the beginner. It is my observation that very often the bowler who has been at the game for some time, and may be a creditable performer in tournaments, is guilty of one or two primary faults, which, if corrected, would raise his bowling average 10 to even 25 pins a game.

What's most important? The answer: Proper equipment, if you really have ambi-

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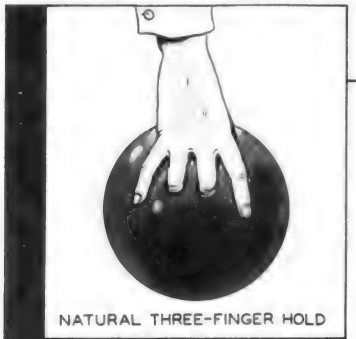
tions to be a class-A bowler. Bowling shoes are not expensive. Get a pair. They will last five years or more. Get a ball, too. With your own ball you will enjoy the game more and bowl better. A ball lasts a lifetime.

If you can't get bowling shoes be sure the shoes you bowl in have rubber heels and leather soles. Never bowl in rubber-soled shoes. The left foot must slide as you approach the foul line, on your final step, and a rubber sole will not permit this. Too, you must use your heel as a brake and the only kind that will so function are of rubber.

Whether you use a two-finger ball or three-finger ball is a decision you will have to make. You can bowl as well with either, and the three-finger ball is easier for most persons to hold. For those reasons I usually suggest a three-finger ball to a beginner, especially one whose finger grip is not strong enough to hold the two-finger ball without tiring.

Don't get the idea a three-finger ball is for sissies. If that grip feels more comfortable to you, use it.

Now for fitting the ball. The ball must be a perfect fit if you are going to score well, and consistently. The method for determining the proper fit is the same for both the three-finger and two-finger ball. The thumb is fitted first, and should be inserted as deep as possible into the largest hole in the ball. The fit around the thumb should be just loose enough for comfort, and tight enough to maintain friction when the thumb is bent at the joint and pulled out of the hole. If there is doubt in your



NATURAL THREE-FINGER HOLD

Your own judgment determines whether you will use a two-finger or a three-finger ball. You can bowl as well with either, and a three-finger ball is easier for most persons to hold. Proper fittings of the holes to the bowler's fingers is absolutely necessary if consistently good scoring is desired. A bad fit is one of the greatest causes of poor bowling.

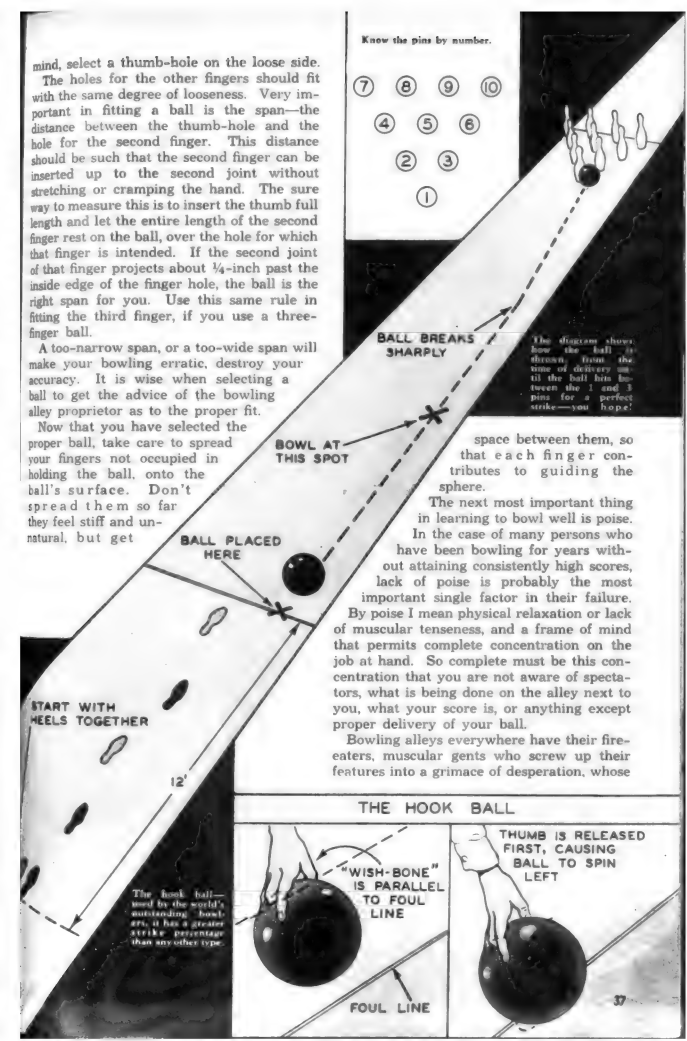
NATURAL TWO-FINGER HOLD

mind, select a thumb-hole on the loose side.

The holes for the other fingers should fit with the same degree of looseness. Very important in fitting a ball is the span—the distance between the thumb-hole and the hole for the second finger. This distance should be such that the second finger can be inserted up to the second joint without stretching or cramping the hand. The sure way to measure this is to insert the thumb full length and let the entire length of the second finger rest on the ball, over the hole for which that finger is intended. If the second joint of that finger projects about ¼-inch past the inside edge of the finger hole, the ball is the right span for you. Use this same rule in fitting the third finger, if you use a three-finger ball.

A too-narrow span, or a too-wide span will make your bowling erratic, destroy your accuracy. It is wise when selecting a ball to get the advice of the bowling alley proprietor as to the proper fit.

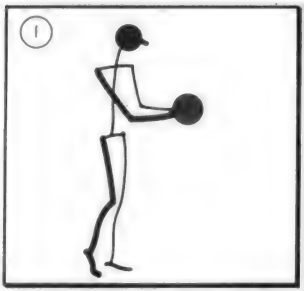
Now that you have selected the proper ball, take care to spread your fingers not occupied in holding the ball, onto the ball's surface. Don't spread them so far they feel stiff and unnatural, but get



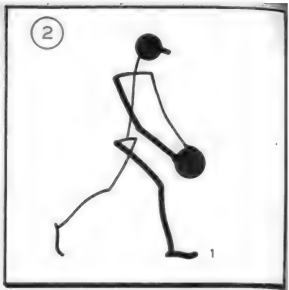
space between them, so that each finger contributes to guiding the sphere.

The next most important thing in learning to bowl well is poise. In the case of many persons who have been bowling for years without attaining consistently high scores, lack of poise is probably the most important single factor in their failure. By poise I mean physical relaxation or lack of muscular tenseness, and a frame of mind that permits complete concentration on the job at hand. So complete must be this concentration that you are not aware of spectators, what is being done on the alley next to you, what your score is, or anything except proper delivery of your ball.

Bowling alleys everywhere have their fire-eaters, muscular gents who screw up their features into a grimace of desperation, whose



The start of the first step. The ball is shoved out and away from you toward the foul line, still supported by both hands. You are bent slightly forward.



First step is taken. Ball is swinging back easily in a natural arc, completely supported by your straight right arm. Eyes are focused on the spot, not on pins.

arm and back muscles become hard as rocks when they swing the ball for delivery—but who will never be really good bowlers.

Here is a little test to show you the importance of relaxation. Stand about arm's length from an ordinary push-button wall switch, the type that turns your ceiling electric light off and on. Now deliberately make your body, leg and arm muscles as tense as you are able. While your muscles are tense, reach out and try to turn the light off and on with your index finger by punching the switch in full arm jab, bringing your right hand back to the chest between jabs.

10 MOST COMMON BOWLING FAULTS

1. Failure to have own shoes and ball.
2. Imperfectly fitted ball. Span too wide or too narrow. Holes too large or small.
3. Failure to spot bowl.
4. Failure to relax physically.
5. Bowling in suspenders or confining vests.
6. Failure to bring ball to shoulder height or higher on back swing, when bowler is in delivery position.
7. Failure to strive for perfection of approach and delivery.
8. Failure to keep emotions steady, avoiding both elation and anger.
9. Use of chalk. It will make your thumb sore, dirty your ball and clothes. Instead, wipe your hands with a clean, dry towel.
10. Failure to throw a ball of uniform speed, in spite of alley conditions.

In ten jabs you are sure to miss the switch several times. Now repeat your efforts to punch the switch, but with body and arm muscles relaxed.

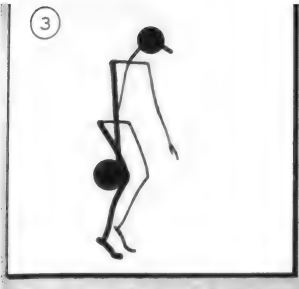
The results should be much better, usually ten perfect contacts with the button out of ten tries. The lesson you learn from this is obvious: If, with muscles tense, you can't punch a light switch at thirty inches, what chance have you to hit a head pin sixty feet away with muscles tense?

Relax, that's the answer, but concentrate mentally on the job at hand.

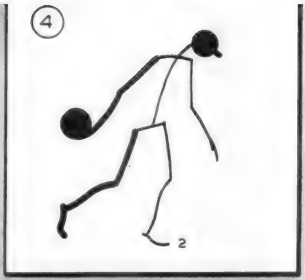
The next thing to determine is the number of steps you want to use in approaching the foul line to deliver the ball. Four steps are most commonly used, once you have learned to handle the ball. This is the most satisfactory number from the standpoint of maintaining the body balance and imparting sufficient forward motion to the ball. Very fat persons or beginners usually find three forward steps more satisfactory. The five-step approach is to be avoided by all except expert bowlers.

To determine the proper distance for starting your approach for the four-step delivery simply pace off four steps, back from the foul line, then add about six inches so your toe won't touch the foul line when you deliver, and mark the distance on the floor with your heel, or even a piece of chalk.

Now take your position, heels on the mark you have made, about six inches in from the right-hand edge of the alley. Stand erect and let your eyes travel from a spot about six inches in from the right edge of the alley at



First step is completed and second step has begun. This position is the start of the three-step delivery, after supporting left hand has been removed.



Second step is completed, third step is started as the ball swings upward. Knees are bent naturally, body is relaxed and bent forward. Eyes on the spot!

the foul line in an imaginary line along the alley surface to the head pin. Somewhere along this imaginary line, from ten to twenty feet from the foul line, find a spot on the alley bed, and focus your eyes on that spot.

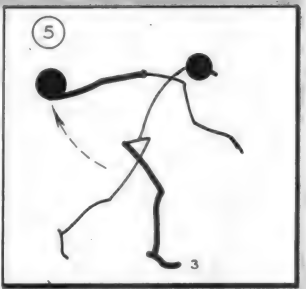
This spot may be a darker board in the alley bed, or a lighter one. It may be a corner of a board, where it joins another of lighter or darker color.

It is at this spot you are going to throw the ball. After the spot is selected you are not to look at the pins until after the ball is delivered. If you are near-sighted, select a spot closer to the foul line, but no closer than four feet from this line.

The reason for picking a spot and bowling at it, rather than aiming and throwing at the head pin sixty feet away, is that it is easier for anyone to hit an object the closer it is to them. For instance, throw a sofa pillow at a door five feet away and you can hit it every time, back off thirty feet and you will miss now and then. By the same logic, it is easier to roll your ball over the spot ten feet away and depend on a projection of its path to place the ball in the pocket between the No. 1 and No. 3 pin, than it is to aim and throw at the target 60 feet away.

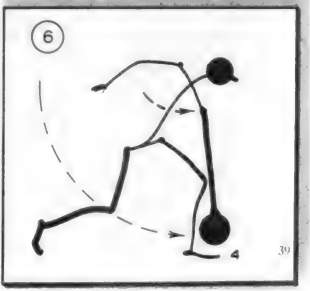
You have taken your position, ball in hand, heels on the mark about twelve feet back of the foul line, six inches in from the edge of the alley. When the proper time comes you are going to lay the ball about six inches in from the right edge of the alley, at the foul line.

Remember you are relaxed, legs straight, elbows bent at right angles, ball at about belt



As the third step is completed, the ball reaches the height of its arc on the backswing, at a point at least as high as the shoulder. Eyes still on the spot!

The fourth step naturally pulls the ball down and forward. Left foot slides forward and ball is released naturally at the end of slide, not forced or "pushed."



height, weight of the ball supported mostly by the open palm of the left hand. Your body is bent forward a bit at the waist. Never bend your knees until you have started your stride to the foul line. The thumb of your right hand is pointed at the head pin. The thumb is about four-fifths of its length in the hole. Your grip on the ball is firm, but not that of a drowning person on a stick. Avoid any semblance of a rigid grip, or "pinch."

The first step forward is taken with your right foot, and as you take it, the ball is shoved out and away from you toward the foul line, still supported by both hands. You are bent slightly forward at the waist. Keep your eye on that spot. Right thumb still pointed at the head pin.

The second step is with the left foot forward, and as you take it the left hand is removed from its supporting position. The ball drops in a natural arc and is supported completely by your straight right arm. Your knees now bend naturally. Forget the pins. Eye on the spot.

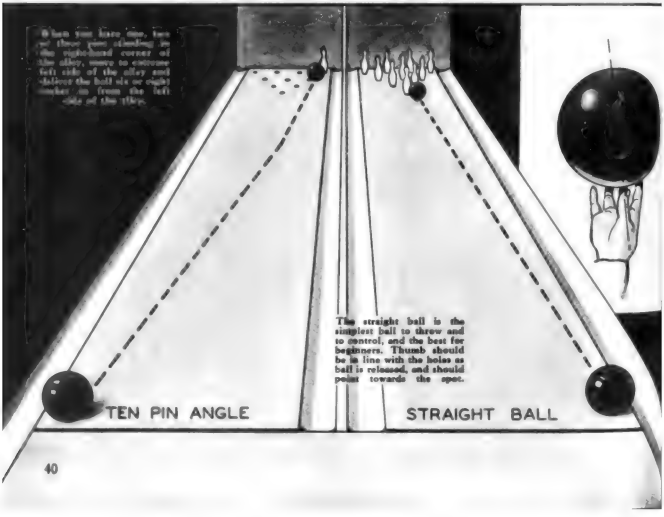
The third step is with right foot forward again. The ball continues its backward movement and reaches the height of its arc on the backswing, at a point at least as high as your shoulders. Knees are bent naturally for comfort. The pins haven't moved, and won't. Watch the spot.

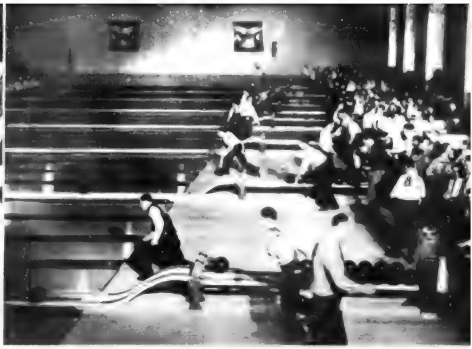
The fourth step, left foot forward, naturally pulls the ball down and forward in the same arc it traveled in the back swing. The fourth step brings your left foot forward in a definite slide or glide, almost in the center of the alley and about six inches back of the foul line. As the forward motion of the left foot ceases, release the ball—but make no definite effort to push or force the shot. Let the momentum the sixteen-pound ball has gathered in the down swing propel it, and let your right arm follow through, easily and gracefully, to a point over your head. Do not take you eye off that spot until you have finished the follow through.

Did your ball curve to the left as it approached the head pin?

If it did, you turned the ball to the left as you brought it down on your fourth step. This is a natural turning of the arm, caused by the construction of the shoulder and its reaction to the weight of the ball at the end of the arm.

If your ball went straight, make no attempt to turn it into a curve until you have had more experience. Concentrate instead on pointing your right thumb toward the spot you have selected on the alley surface as you





Bowl! At the right are a few of the bowlers who took part in the 19th renewal of the American Bowling Congress held last year in Cleveland, Ohio.

deliver your ball. This puts the thumb out in front at point of delivery, fingers behind the ball. The thumb always leaves its hole first, before the second finger, or second and third if you are using a three-finger ball.

If your ball curved after it left your hand, your thumb of the right hand was pointing at the foul line when you deliver the ball. That is, the thumb and index finger formed sort of a wish-bone, which was parallel to the foul line, with both thumb and finger pointing at it. (See diagram).

The three-step delivery, referred to previously as best for beginners, is the same as the last three steps of the four-step delivery. Start your forward motion, ball slightly extended before you. Take the first step with your left foot, instead of your right. Remove the supporting left hand as your left foot goes forward and let the ball fall into its downward arc. Continue as with the four-step delivery.

Practice your delivery until you do it automatically, with ease, confidence and grace. Always practise with a ball in your hand. This weight is necessary to co-ordinate your timing, and hours of practice without a ball are not only wasted but harmful.

A straight ball is safest for a person bowling only a few times a week. It is easier to control, with less practice. A curve ball should be cultivated only by the individual who has ambitions to be a really excellent bowler. Even then it should be the "hook" ball, rather than the curve that the individual should strive for. This is a curve ball that breaks fast, traveling in a straight line toward the No. 3 or No. 6 pin, then curving sharply from right to left and coming into one 1-3 pocket. (See diagram).

The advantage of the hook is that it reduces the tendency of the ball to deflect, or change its path after striking the pins, and will carry through to get the No. 5 pin even on thin hits. Thus, the hook ball will get more strikes, also due to the fact that the spinning motion of the ball is imparted to the pins, resulting in more "scatter" strikes on poor hits.

To get a really fast-breaking hook it is necessary that you turn your hand to the right on the backswing. Then, on the last step to the foul line your wrist turns to the left throughout the arc of the down swing, bringing your thumb toward you and enabling the middle finger to give a distinct spin to the ball as it leaves the hole (middle and fourth finger on a three-finger ball).

I repeat, don't try to develop a hook unless it comes very easy for you, and you intend to bowl a great deal. From all practical angles it is better to perfect a straight ball first, keeping the thumb ahead of the ball at all points on the backswing and delivery, and not turning the wrist.

Caution. Don't use too much speed. No really good bowler throws a terrifically fast ball. Your objective should be to throw the ball with the same force at all times, just hard enough so that you do not have to strain. There is no prize for breaking the pins and accuracy cannot be maintained with high speed. There is also the very practical reason that a too-fast ball will knock pins out of the alley that should be working to knock down

[*Continued on page 116*]

Touring Easy With Push-Button Top

THE picture above shows the operating mechanism of the automatic, or push-button top, on the new Ford de luxe club coupe. It consists simply of a piston and cylinder unit which raises and lowers the top by means of vacuum power from the engine, controlled from the instrument panel.

Dobbin Gets The Kicks Cranked Out

THIS canvas belt, when cranked, raises a horse almost off the floor so he can't get set to kick, and can be shoed in safety.

New River Steamer Is Streamlined

THIS new excursion steamer, which was recently completed in St. Louis, is an example of the trend of streamlining. Claimed by its owners to be the largest river excursion boat in existence, the craft is nearly nonsinkable due to 72 watertight compartments in the hull. It has five decks, four for the passengers and one for the crew, and is composed almost entirely of metal and glass.

Not Like The Old Days

STRETCHING high into the sky is the new 718-foot antenna tower of Station KDKA, in Pittsburgh. Backed by a 50,000-watt transmitting station, it was put into operation just nineteen years after this station broadcast the world's first scheduled radio program over a puny little 100-watt transmitter. The lineman in the foreground is connecting the frequency transmission line.

You Have To Be Part Tarzan For This Job

LANDING in tree-tops is nothing new for Frank Derry, famous parachutist, since he joined the United States Forest Service to help it develop methods and equipment for fighting forest fires from the air. The service plans to send men from planes to fight fires in inaccessible spots in our western forests. A sponge rubber and canvas suit helps to keep out the heat, and helmet and face guard are worn to prevent injury in landing.

Bottoms Up!

IT LOOKS like an aviator's nightmare of a mass crack-up, but it's just the way one airport solves a "parking" problem. Due to lack of space, these light planes are set up on their noses in a hangar at Boston Municipal Airport, their propellers protected from injury by wooden blocks. By using this unique, if unorthodox method, 15 ships can be stored in the same space that five would ordinarily use.

Radio Servicing

MECHANIX ILLUSTRATED presents the second in a series of vocational analysis articles designed to help you choose the job best suited to you. No one except yourself—not even parents—can choose for you the work at which you will spend a lifetime. You may already be working at some job unsuited to your real talents. The facts presented in these articles are drawn from outstanding authorities in their fields, the tests carefully designed to reveal your real talents as well as to help you in analyzing them.

Next month the occupation of Photography will be discussed.

Modern radio receivers are complicated, and a service man must "know his stuff" if he expects to make a success of his business.

by Donald G. Cooley

A MAN from Missouri wanted to find out whether his son was destined to be a lawyer, a farmer, or a banker. He left the youngster alone in a room in which he had previously placed a legal volume by Blackstone, an apple, and a dollar bill, free to choose whichever object appealed to him. Ten minutes later the father looked into the room and found the boy sitting on Blackstone, eating the apple, with the dollar bill safely stowed in his pocket.

"He's going to be a politician!" cried the delighted father.

That's an exaggerated story, of course. But it does suggest a revealing experiment which—if you have decided you would like to be a radio service man—will tell you a good many things about yourself. Here it is:

Pick up an antiquated or discarded radio set and lock yourself in a room with it. Take

it apart. Put it together again. Trace the wires. Follow out the circuits. Try to replace screws in close corners where there isn't room enough to move your fingers.

How do you like it? Do you lose interest before you finish the job? Does the job seem to tough to you, too tedious, too hard to learn? Then think twice before you go in for an occupation that requires endless hours of exactly that type of work. But if you get a kick out of tinkering with the chassis, if it's a mental and manual challenge that keeps your interest keen—then you're very likely the stuff a good radio service man is made of.

Of course, deciding on a vocation isn't quite so simple as that. Have you ever stopped to think *why* you want to be a radio service man? There are plenty of good reasons, but only if they apply to *you*.

The main signpast pointing toward the life-work in which you will be most successful is labeled *interests*. You are especially well suited for radio work if some of these statements are true about you:

You already know more about radio sets than the average person. You have tinkered with your own set or those of neighbors. You are a "ham" operator or pal around with someone who is. You like to study diagrams and read about new developments in radio trade papers. You have a good working knowledge of electricity. You "talk the language" of radio technicians. You have put together apparatus of your own.

These traits indicate a strong aptitude for radio work, but they should be supplemented by other practical qualifications which you can analyze for yourself by taking the MECHANIX ILLUSTRATED vocational test on page 47.

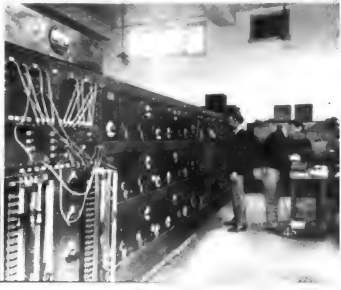
An astonishing fact about radio service work is that three-fourths of its practitioners are in business for themselves. That's a record few other industries can match. Are you the type of man who yearns to hang out his shingle and be his own boss? Do you combine initiative with practical business sense? Then radio servicing offers you a fine opportunity to build your own business.

Remember, though, that running your own business is no bed to roses if you happens to be the kind of person who needs someone to keep pushing him. That's why those personality questions are so important in the vocational aptitude test.

Make no mistake about the fact that radio service work is practically tops among semi-professional occupations. Army data and

Above: The well-trained technician with a desire for travel will find many opportunities in shipboard radio operating. "Sparks" on a modern vessel, such as this one, is rated as an officer; is paid and treated as such.

Below: Commercial radio telegraph and telephone stations require expert personnel. An ambitious service man can rapidly graduate into this work.



Below: Many service men become well-paid salesmen because their technical background enables them to talk convincingly about radio sets to prospective customers.

Left: The booming aircraft industry is badly in need of competent radio men who can install, operate and service the complex communication apparatus that is an essential part of every airliner.

Below: Television is still hiding around the misty corner, but sooner or later it will be a big industry, offering lucrative opportunities to radio service men. And complicated television receivers like this one will need plenty of servicing!

other reliable sources agree that the electrician's vocation—of which radio repair work is a specialized branch—ranks highest of all skilled trades in its demand for intelligence and ability to learn. You bet you can be proud of your occupation, because the dimwits never get far in radio.

Let's be practical about this business of radio servicing. It demands plenty from you; its rewards can be in proportion.

Consider, first, the demands. You will be expected to diagnose and repair radio troubles right on the spot. When a man's set goes haywire in the middle of a Joe Louis slugfest, he wants action and he won't hesitate to call you at 10:30 p. m. to get it. Your health will have to be resilient enough to stand night calls. And your nerves. If you feel owly when you get a call just as you're ready for bed, the customer must never know it.

You have to have keen vision for close work, too. You should have an aptitude for "spatial relationships," as the analysts call it. In everyday language, that means that if you are given the parts of some disassembled mechanism, you can readily visualize them in their proper positions, and in reasonably short time can reassemble them. There are elaborate psychological tests to measure this particular kind of mechanical aptitude, but a little actual experience in assembling radio sets will leave you with little doubt whether or not you possess the quality. You can, if you like, work such a test on yourself if you will have a friend take apart some unknown mechanism—unknown to you, that is—and lay the pieces on a table. If you perceive swiftly that the switches, screws, nuts, and stampings are parts, say, of an electric iron, and if you can assemble them speedily with no parts left over, you may feel that your "spatial relationship" quality is okay.

You will notice that the vocational test for radio service men contains a number of questions that have little to do with mechanics, such as "Do you take good care of your personal belongings?" Believe it or not, those questions have a lot to do with your radio qualifications. It has been found that the chap who is careful and orderly in caring for his belongings is likely to be careful and orderly in working with a thousand and one small parts—and if he isn't, his workshop is going to be so cluttered in a week that he might as well go out of business.

In short—your personality and character qualities have a lot more to do with success

Test Your Aptitude for the Vocation of RADIO SERVICE MAN

Answer each question honestly, taking all the time you want; check "Yes" or "No" in the proper column	YES	NO
Do you already know more about radio sets than the average person?		
Can you operate a typewriter, play a musical instrument, or do other things requiring skill with hands and fingers?		
Do you have a good memory as a storehouse for small details?		
Were mathematics, science, and shop subjects your favorites in school?		
Are you conscientious—unsatisfied to leave jobs half-done?		
Do you understand these technical terms: alternating current, transformer, condenser, loudspeaker, filament, amplifications?		
Would you spend more time at a museum exhibit showing electrical apparatus than you would at one showing animal groups, old books, oil paintings, or locomotives?		
Do you think over a task before starting it, rather than rushing ahead?		
Is your liking for working with your hands about equal to your liking for dealing with people?		
Do you have a number of friends, acquaintances, or associates who are interested in radio or electrical occupations or hobbies?		
Have you done much tinkering with your own radio set or those of neighbors?		
Can you drive an automobile?		
Can you stand fairly long hours with occasional night-calls?		
Are you friendly, courteous, of good appearance to make a good impression when entering people's homes?		
Do you have a good vocabulary, with ability to talk well enough to convince people you know your business?		
Is your vision keen enough for delicate close work?		
Would radio afford a reasonably complete outlet for your abilities?		
Can you learn readily from books, follow complex wiring diagrams?		
Do you have at least a grammar school education?		
Are you a "ham" radio operator, or do you have a friend who has an amateur station?		
Do you take good care of your personal belongings?		
Can you follow another's directions accurately?		
Are you a "self-starter"—i. e., enough initiative to keep going under your own steam without someone to push you?		
Are you free from handicaps that might make it difficult to acquire manual skills or to get around easily?		
Do your friends think you would make a good radio service man?		

To score yourself, count 4 for each "yes" answer; "no" answers do not count. A score of 72 or better indicates that you are well qualified for the technical phases of the vocation; a score of 80 or higher, that you probably possess both technical and commercial qualifications in satisfactory degree. If your score falls much below 68, it would be well for you to consider a different occupation.

in radio than they do in other mechanical fields. Your work will carry you into customer's homes. You have to make a good impression. You must be neat and courteous, and it helps plenty, in any field, if you really *like* people. For you will be almost as much a salesman as you will a repair man, unless you expect to confine yourself to shop or factory. You should be able to talk easily, with enough words at your command so you won't have to stumble and grope. If you really know your stuff, the words will take care of themselves.

Do the rewards of the radio service man justify the superior qualifications demanded of him? Let's examine what the trade offers.

You still hear it said sometimes that radio is an infant industry. It isn't. It's one of the most solidly organized industries you can find anywhere in the world. It is still growing, and technical improvements will continue to come, unpredictably, for years. But the days are gone when anybody who could talk impressively about kilocycles, audio-frequency, rectifiers and the like could call himself an expert and get away with murder. Today you have to *know your stuff*, if only because there are approximately 100,000 service men ready to compete with you.

Fortunately, excellent training in radio service work is readily available, wherever you may live. High schools, vocational schools and colleges offer various types of courses embracing radio. Make local inquiry about these; your high school principal or board of education can help you.

There are also excellent commercial schools which specialize in radio training. These are of two types: residence schools, and

[*Continued on page* 118]

Bossie Gets The Breaks

ABOVE we see a demonstration of the newly-invented diathermy machine for applying heat treatment for adhesions and other ills to the udders of cattle. At the right, a contented cow peers out from behind an electric fly screen, the most recent device to save wear and tear on bossie's fly-swatting tail.

It Would Be Some Fall!

BRYANT GUTHRIE, of Edinburg, Texas, has his own ideas of what it takes to get up in the world. He cooked up this awesome looking contraption from short lengths of pipe and the frame of an old bicycle. He plans to use it as an advertising medium.

The Evil Eye?

NO, AND she isn't trying to frighten anybody, either. Her eye is being illuminated by the ophthalmoscope, an important eye-testing instrument, which enlists the aid of Polaroid to shoot a beam of light straight through the eye into its background.

Beauty Takes a Beating

WHAT women will do to make themselves more beautiful is strikingly illustrated by the pictures on this page. The devices which today's beauty experts have cooked up to improve on nature look like weird contraptions out of an Edgar Allan Poe horror tale. Torquemada, supreme inquisitor of the Spanish Inquisition, would undoubtedly blush with shame if he were alive to see the tortures which he overlooked during his reign of terror.

No sir, the next time we get to thinking about what an easy life the ladies lead, we'll just turn to this page, take a squint at these pictures, and breath a deep sigh of relief that we're of the opposite sex.

The ugly looking contraption at the upper left exercises muscles which are seldom used. We know the picture of the pretty girl above was taken before the battle—she looks too peaceful to have gone through it! Below is a rubber mask through which hot water circulates, increasing the circulation of the blood, and toning up the skin. At the lower left is an electrical heat pad to open pores so that beauty creams may be applied more effectively.

Hurray For Our Side!

THE girls below are trying out "Goal-Hi," a new type of basketball game which recently had its premiere in Lawrence, Kansas. Invented by Dr. F. C. Allen, the game can be played either indoors or outdoors, around a goal of regulation size and height mounted on a tripod metal pedestal.

Midget Casts Mighty Beam

THE newest development in photography is the "mighty midget" photoflash bulb, the size of a walnut, and smaller than a golf ball. The picture at left shows the bulb in action at Cleveland's mammoth Public Hall. Placed in a spot-type reflector, the lamp was placed 265 feet from the auditorium stage, nevertheless, so powerful and direct was the "hit" scored by its flash beam that a camera was able to "get" the man shown on the stage.

Fire When Ready, Gridley

LOOKING more like a machine gun than a microphone, this directional "mike" is the newest device for broadcasting crowd events. The longer tubes are used to pick out individual noises in a very small area of the crowd, while the shorter tubes catch the "background" noises of the entire gathering.

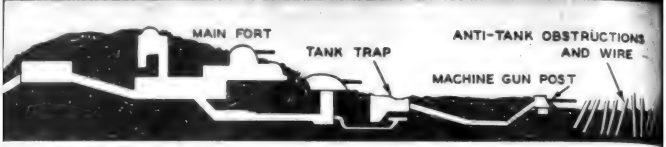
BOX YOURSELF A BUNGALOW

e picture shows the box bungalow in early stages of construction. ow: Mr. Church and finished house. Right: Interior construction.

A REVOLUTIONARY type of home construction has been inaugurated by A. A. Church, of Porterville, California. Mr. Church built the sturdy little bungalow, shown in various stages of construction on this page, entirely out of new grape-picking boxes. He claims that the box walls form dead air insulation which gives a cooler building in summer and a warmer one in winter than are found in more orthodox types of construction.

The house has been carefully built, and all small details which are necessary in any such pioneer building venture have been worked out.

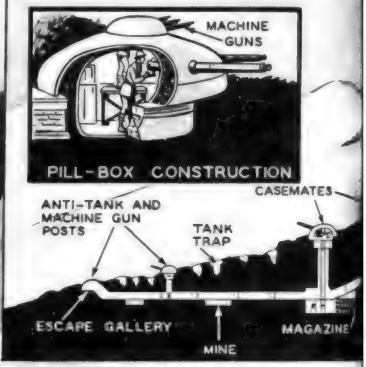
Enthusiastic over his house, Mr. Church predicts that it is but the first of similar houses that will spring up over the nation.



CAN THIS WAR

Modern fortifications along the Maginot and Siegfried lines have made France and Germany "invasion proof." The result may be a war no nation can win!

by Maxwell Hamilton



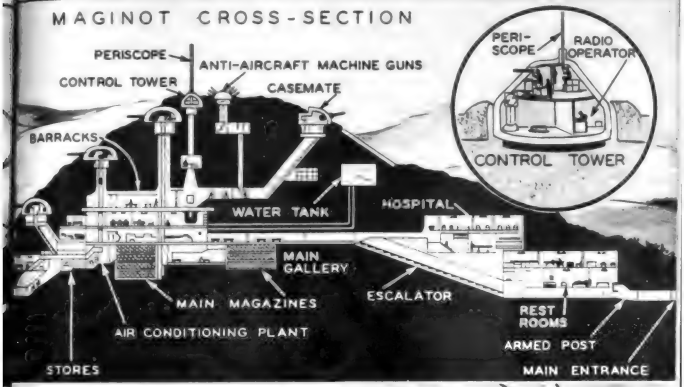
WHAT happens when an irresistible force meets an immovable object?

This age-old problem in physics, a familiar question to every school boy, seems destined to find an answer in Europe's latest armed conflict. For the present "war to end wars" is a contest between two of the world's greatest immovable objects—the Siegfried and the Maginot lines!

Imagine, if you can, an advancing horde of 2,000,000 men. It is armed to the eyes with

BE WON?

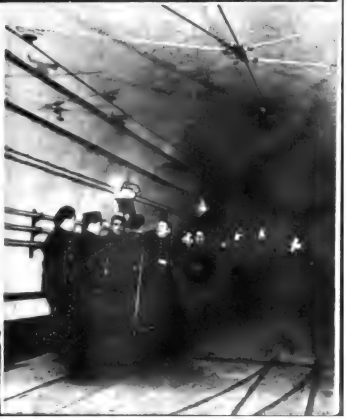
Above is a comprehensive cross-section sketch of the famous Maginot line, showing the traps which are waiting for an attacking foe. Below is the inside of a typical sector of the line, showing the subterranean passages, barracks, and ammunition magazines. A huge army lives underground as France waits a German attack.

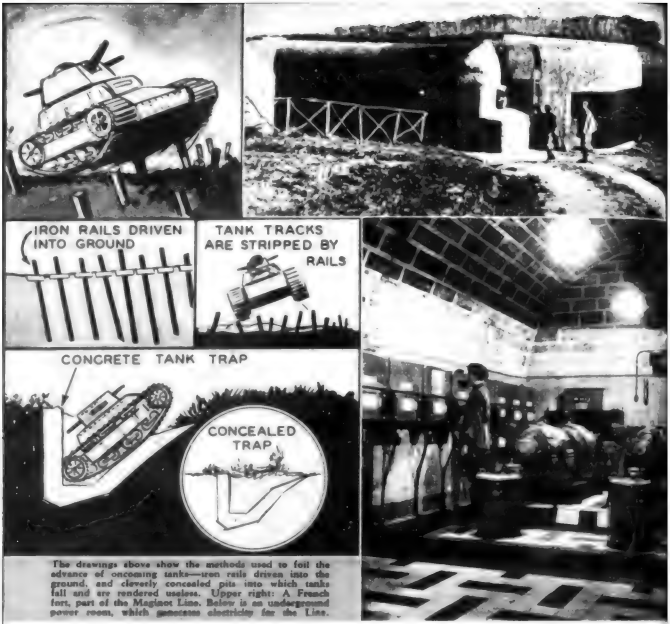


Right: French troops passing through a tunnel of the Maginot line, more than 100 feet below the surface.

high-speed, rapid-firing tanks, motorized cavalry and infantry, mobile artillery and ammunition units, every known type of poison gas, and the most modern and efficient equipment available for pouring forth a ceaseless storm of shot and shell, endless tons of lead, steel and flame. Magnify this glittering array of death on the march five times over—and, against it, the French defenses on the Maginot line still would remain impregnable!

On the other hand, should the Allies abandon such snug security and launch an attack of their own, just as much power and strength and cunning, multiplied many times over, would avail them nothing. The German Siegfried line—not 10 miles away—is just as redoubtable, just as impossible





The drawings above show the methods used to foil the advance of oncoming tanks—iron rails driven into the ground, and cleverly concealed pits into which tanks fall and are rendered useless. Upper right: A French fort, part of the Maginot Line. Below is an underground power room, which generates electricity for the Line.

to penetrate, as the French fortifications.

It is Armageddon, giant against giant, with victory in the lap of the gods.

Of the two great bulwarks, the French Maginot line would seem to have whatever slight advantage exists. Begun 10 years ago, it has cost France $300,000,000 and has taken all of the intervening years to complete. It is modern, it is thorough, it is highly scientific. The German counterpart, on the other hand, is a product of feverish building over the short space of the last year and a half, with the natural weaknesses of hasty construction deemed certain to appear under fire.

It is to the late Andre Maginot, ex-War Minister of the French Republic and veteran of the First World War, that credit for these amazing fortresses must go. Lying wounded and despairing in a 1917 base hospital, Maginot, a sergeant of artillery, stared at the bullet-pocked ceiling above him, gritted his teeth and groaned with pain.

"I *hate* war," he muttered. "I abhor it."

Eighteen years later, in a meeting of France's Supreme Council of National Defense, Maginot, the new war minister, 6 feet 2 inches of man, rose to his feet, outlined on a map the French border from Luxemburg to Switzerland and stated his position coldly and determinedly.

"We must build a wall along here," he said, "that the devil himself can't break through!"

The result: the Maginot and, later, the Siegfried line.

In a time of peace, you might cross and recross the Maginot fortifications and see nothing but rolling hills, dense thickets and an occasional peasant's shelter. If you were particularly observant, you might note a scattering of small, dome-shaped mounds

protruding from the earth, mounds which—in any other locality—would certainly be taken for underground reservoirs or drainage tanks.

Far from drainage tanks, these mounds mark almost the only visible evidence of the greatest fortifications in the history of France! These are pill-boxes, heavily armed, constantly manned—and facing east. What looked like an ordinary thicket turns out to be an enormous cruel mass of twisted barbed wire, and what might have been taken for a peasant's shelter is, in reality, a block-house, with walls 60 inches of cement and steel and blended into the color of the hillside.

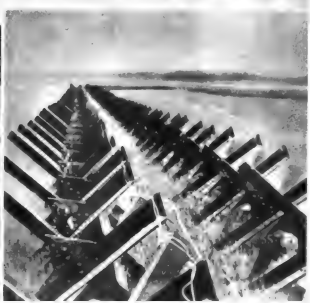
The Maginot defenses really comprise three parts.

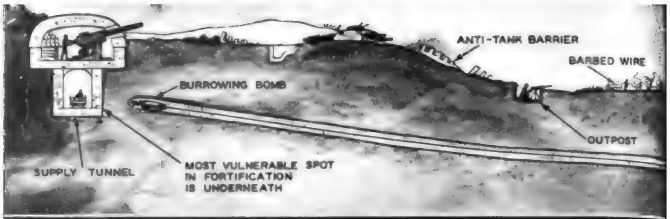
The first consists of the pill-boxes—the dome-shaped mounds—built along the base of the hillside. Although connected with the other fortifications by underground passageways, each pill-box is a separate unit, isolated, to be sold out to the invader at the highest price. It is manned with the very latest type machine guns that can fire for 24 hours without a stop. It has sanitary facilities and is stocked with ammunition, food and water; for it is its purpose to impede the enemy, discourage his advance and then surrender only when its occupants are dead. For volunteer "suicide squads" will man *these* outposts.

Behind the pill-boxes are the block-houses, containing machine and field guns and connected with each other, and the rear, by subterranean tunnels. They, too, are independent units, capable of standing on their own and—when pill-boxes have fallen—of setting off mines in the passages between these units in order to cut off access through that quarter. The third part of the line also consists of block-houses, only this time they contain more powerful defenses—75 and 155 millimeter cannon (3- and 6-inch)—radio stations, observation posts, field headquarters, and so on.

But these are but surface manifestations of the great Maginot defenses, and, like an iceberg, France's newest forts are $^{7}/_{8}$ths under the surface. Behind the three front lines, and deep in the bowels of the earth, are the living quarters and administration divisions of the defenders. Thus, as fast as front line troops grow weary, fresh detachments are ready and

Left: A mountain dugout on Germany's Siegfried Line, not far from France's Maginot fortifications. The two photographs below show how Germany expects to keep the giant French tanks at bay. The one at the left shows a line of concrete tank traps, while the one directly below shows a double barricade of crossed angle irons.





On these pages our artist has drawn a "Burrowing Bomb," which might answer the invulnerability claims of both the Germans and the French as to their defenses. This mechanical "mole" would carry an explosive charge and be directed through a control cable by men in the dugout from which it was started on its way. How it would operate is shown in the upper sketch. At the right are shown close-up drawings of the "mole." Could Hitler have had such a device in mind when he uttered his threats of "weapons known only to Germany?"

able to go into service. And should the enemy penetrate the three outer walls, he is met back of the lines by brigade after brigade of well-equipped fighters who pour out of the cavernous reaches of the underworld from all sides.

Within the heart of the hillsides, an army can live for months in the ingenious recesses of which Andre Maginot dreamed. There are comfortable steel-lined barracks, air-conditioned and strengthened to withstand five times the assault put upon them in their first tests. There are escalators from one level to another, kitchens, hospitals, ammunition dumps, reservoirs—even wine cellars and recreation rooms. Telephone cables are steel-insulated to withstand the shock of high explosive, and when they fail there is the radio. If that goes dead, then pigeons go into action.

The fact that the superstructures are located on hilltops minimizes the poison gas nuisance. Gas needs dry weather and low, windless country; but, even if it came, the Maginot line would be ready for it. Guns are set in water-tight jackets and embrasures that defy the entry of gas; and the smoke and fumes from gun discharges within the fortifications are ingeniously disposed of through ducts which permit exit but not entrance. The air in these defenses, aided by pressure, is as pure as that of a mountain cave.

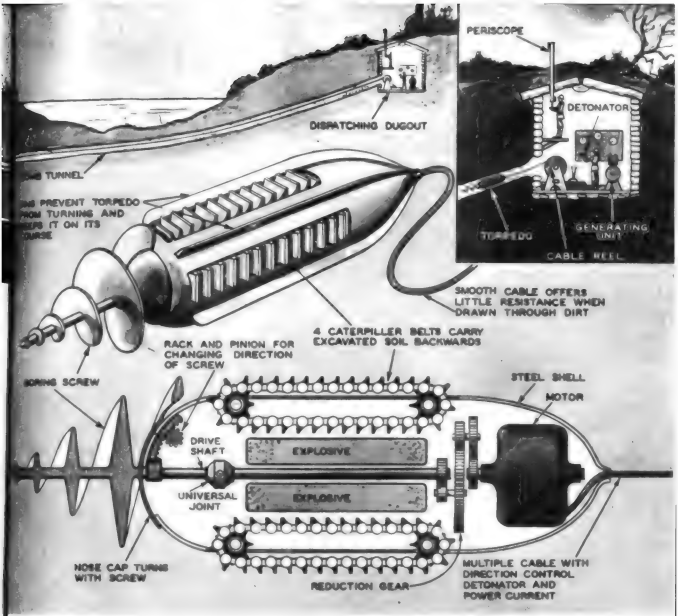
As safe as they are inside, the inhabitants of both the Maginot and Siegfried lines are amply protected on the surface. Andre Maginot, as well as his rivals across the German border, realized that such defenses might be surmounted or crushed easily by the fast and powerful tanks of the war that was to come, and this angle has been taken into consideration.

Machine gun nests, block-houses and other defensive works are skirted by a veritable morass of tank traps. Thousands of steel rails, set end upright in solid concrete and steel, and with their upper ends protruding at different heights out of the earth, stand like a garden of irregular bean poles to impale the fastest tank and strip its belt tracks. If an enemy driver successfully skirts this "asparagus," and is not disabled by the withering anti-tank cross-fire which besets him from pill-boxes and block-houses on all sides, his troubles have just begun. For he will find that the most solid earth will turn out to be a deep, wedged-shaped pit, concealed by grass and underbrush, and into which he will sink out of action.

In the meantime, the infantry is having its troubles in jungles of barbed-wire, carefully woven and supported in days of peace, when things can be done carefully and devilishly. In some instances, these nests of wire are even electrified to put the crusher on any army that dared to try to pass or cut them.

In this latter respect, the German and French defenses are much the same and present no dissimilarity to the casual observer. The German "asparagus" protrusions are different only in that the rails have been encased in concrete and stretch in columns of four for miles and miles along the border. They were built by Fritz Todt, German road expert, who drove an army of 500,000 workers for more than a year before completing the project last Summer.

With this minor difference, and despite the denials of Adolf Hitler, the German West Wall—as the Siegfried line is called in the Reich—is almost a copy of the Maginot fortifications. There are reputed to be almost 600 of the hillside, pill-box forts of the Maginot type on German soil, all complete with living quarters, air conditioning, latest



type armanents, plumbing, telephones, radio and recreation facilities.

The German barricades extend more than 400 miles along the frontier, are drilled—in some places—as much as 30 miles into German territory, and are said by Der Feuhrer to be able to withstand any attack, whether from air, by tank, by gas or heavy artillery.

The British have deprecated the efficiency of the German line on several occasions. According to their reports, the subterranean dug-outs of the Germans may be able to thwart any human enemy but were flooded by the high waters of the Rhine last Summer, forcing a hasty evacuation. Furthermore, they say, the German soldiers are unhappy underground because of the fact that the galleries are crammed to overcrowding with ammunition, the air conditioning doesn't work and ventilation is bad, and there has been a marked shortage of food, forcing the troops to come out and show their hideaways.

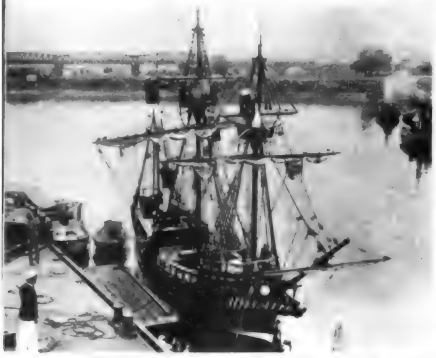
Regardless of these rumors, however, it is apparent that both teams have power aplenty to stave off attack from all sides, and neutral observers are of the opinion that this new war really may be *the* war to end wars. They point out that, with neither side able to gain any ground on the other, they will have to resort to air raids and bombing of non-combatants, and eventually—like invincible knights of King Arthur—both sides will battle to exhaustion. And the conflict will be at an end.

But man's best laid plans sometimes go awry. Both Germany and the Allies are rumored to have some secret and amazing weapons which they are saving till the real scrap begins. If these rumors are true, then guesswork goes out the window.

The question is, however—Have the boys got such weapons?

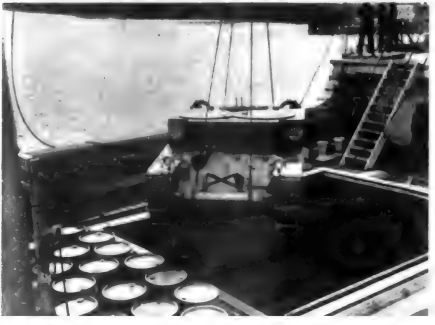
Loom Makes Crippled Children Happy

LIFE will be a lot pleasanter for crippled children, thanks to the bed loom shown here, the invention of Margaret Greave, of the Riley Hospital for Crippled Children, in Indianapolis. Miss Greave is shown teaching a young patient how to operate the loom. With it, Miss Greave won the first place award of the National Association of Occupational Therapists for the outstanding contribution of the year.



"Golden Hind" To Sail Once More

THIS half scale model of Sir Francis Drake's famous fighting ship, *Golden Hind*, was built by members of the Mechanical Training Establishment, at Plymouth, England. The men are giving the handsome little ship a thorough going over so that it will be ready for exhibition and sailing during Navy Week. At this time the public is admitted to the Royal Dockyards, and funds are collected for widows and orphans of British sailors. The men appear like giants against the rigging.



But Will The Penguins Like It?

ONE of the two army tanks to be used on the United States Antarctic Expedition is being loaded on board the cutter *North Star* at the army base in Boston. The tanks weigh eight tons each, and are equipped with special ice clamps on the tractor belts for greater facility in travel over the icy wastes of the South Pole region.

FLOWERS THAT LIVE FOREVER!

ROSES that never fade or wither, carnations that look fresh and glamorous for years, bridal bouquets or corsages permanently preserved in all their beauty, exotic plants and blooms brought home just as they were found in their native jungles, all these dreams of lovers of nature have been made realities by a process developed, perfected and patented by Philip Joffe, a New York City High School teacher, in the improvised laboratory of his apartment near Central Park West.

Mr. Joffe, who holds six other patents, one a musical device endorsed by such authorities as Damrosch, Rachmaninoff, and the late Caruso, is one of that tribe of so-called garret inventors who refute the notion that all important inventions of the future will emanate from elaborate research laboratories maintained by industrial corporations.

[*Continued on page* 125]

A garden on the living room rug. Philip Joffe looks over the permanently preserved plants and flowers.

Testing the temperature of the solution. Too hot for the hand to bear, it is harmless to the flower that is to be preserved. Right: Watering a preserved "garden."

Where Do They Keep The Towels?

THIS new foreign limousine has a hot and cold water folding wash-basin of aluminum built into its right front fender. Beneath the hood is a 2-compartment tank holding two and a half gallons of water. The hot water section is heated by exhaust gases passing through a spiral pipe. The two faucets give water of any desired temperature. The basin is automatically emptied when it is folded into the fender.

One Man Can Start Plane With Crank

AN UNUSUAL safety feature of this light plane is the strategically placed engine starter crank which is installed so that it is possible for the pilot to control the throttle in the cabin at the same time he is "turning over" the motor. This eliminates all danger of the plane "running away" and at the same time there is no necessity for another man to turn over the engine while the pilot sits at the controls.

Sun Supplies Heat For This House

OLD SOL provides the heat for the hot water system in this new sun laboratory, recently completed at Massachusetts Institute of Technology for research on using the sun rays for house heating and power generation. The man on the roof is Dr. Byron B. Woertz, research assistant, who is inspecting energy collectors, or "heat traps," in which circulating water is heated by sunlight and stored in a large basement tank for future use.

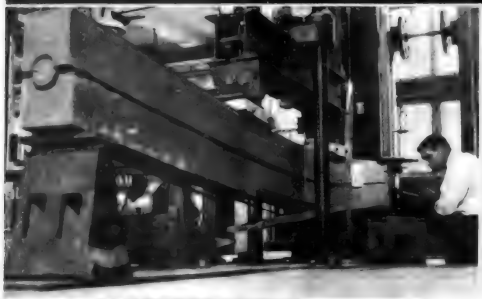
90-Ton Tanks Are France's Fullbacks

THE battering power of the new French 90-ton tank is terrific, far exceeding anything known in the last World War. As the above pictures show, the mechanical monster plows through stone and brick walls as if they were made of papier-mache, and it snaps trees as if they were twigs.

Ski Patrol Brings Aid To Injured

OUT on the slopes of Oregon's Mount Hood expert mountaineers have organized a ski patrol which has already rescued 310 skiers who were in serious predicaments. Members of the ski patrol are trained in handling toboggan "ambulances" under any conditions.

WOOD Makes a



One of the methods of research used by the Forest Products Laboratory is shown at the left. A length of structural timber is undergoing a loading and bending test. The beam is being subjected to pressure as an expert maintains a telescope on the point of greatest pressure to determine characteristics of this wood for building purposes. A load of 50,680 pounds was applied to this piece before breakage.

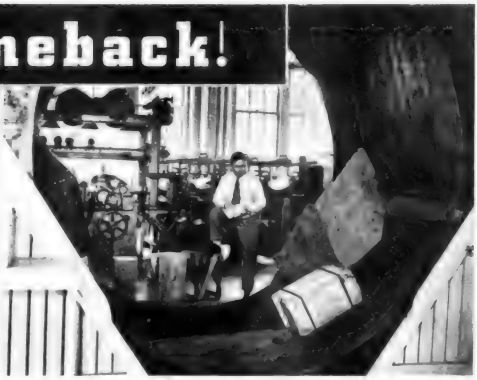
SINCE early days, wood has provided Americans with homes, stores, farmsteads and factories. Over half of all the wood cut from the forests still goes into building and housing. But in recent years wood construction has lagged and other materials have come in, because antiquated, inefficient wood building methods have persisted. The provision of easily erected, economical and comfortable homes for families of small means is one of the most urgent needs of our time, and the development of more efficient use of wood for

Specialized service in wood identification is offered by the Forest Products Laboratory. One of the experts in this line is Arthur Koehler, shown above studying woods with a microscope. Mr. Koehler's work in identifying wood used in the Lindbergh kidnaping ladder was greatly responsible for Hauptmann's conviction.

One of the most valuable researches undertaken by the Laboratory is that into wood preservation. The effectiveness of preservatives is tested and then checked by thorough trials under actual service conditions. The picture at the right shows fence posts being synthetically decayed with zinc chloride.

Comeback!

An essential service performed by wood in commerce and daily life is in the form of containers for commodity shipments. The work of the Forest Products Laboratory in improving the strength of boxes and crates has led to savings to the consuming public, in freight handling charges, losses, and damage to goods, amounting to millions of dollars yearly. Shown at the right is a box testing drum which, when revolved, picks up and drops a box or crate in every conceivable manner to test strength and find construction faults.



this purpose presents a broad responsibility for research.

Dedicated to this research is the Forest Products Laboratory, at Madison, Wisconsin. Hundreds of thousands of mechanical tests have been made at the laboratory to determine the strength characteristics of more than 160 native woods, for the purpose of adapting wod more effectively and satisfactorily to its various uses.

Tests of full sized timbers have demonstrated in quantitative fashion the influence of common defects, such as knots and checks, on strength, with the result that structural designers have been supplied with more efficient working-stress values, building codes are being modernized, and timbers are bought and sold on the basis of strength grades, by which they can be rationally and economically selected for their intended loadings.

The pictures on this page show but a few of the many ways in which the Forests Products Laboratory is learning things about wood, things that will benefit all of America.

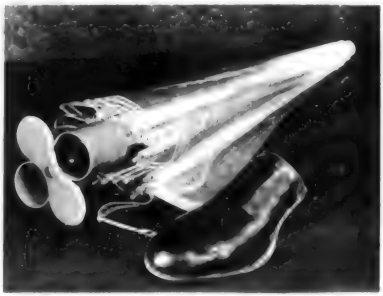
At the left experts are weighing and measuring green wood specimens so shrinkage data can be determined when the wood dries. Uncontrolled shrinkage causes checks and splits, cupping and warping, honey-combing and casehardening. Above: One of the two experimental prefabricated houses built at the Laboratory, on which extensive studies centering on structural problems have been made.

Ice Without Ice Is The Latest Trick

THIS new machine, demonstrated recently at the Detroit Auto Show, produces "Iceolite," a surface for ice-skating in any season without refrigeration. The girls watching workmen operate the machine are from the skating ballet which performed on the new surface and found it a worthy substitute for ice. The machine, if taken up, may find us all cutting "figure-eights" during the hottest dog days of the summer months.

Page Mr. Chamberlain!

BRITAIN'S prime minister would undoubtedly be fascinated by this latest rainy-day gadget, which is called the "Umbrubber." Made to protect the user against sudden showers that might spring up, the device has a special handle of plastic which contains a pair of light-weight rubbers. In the event that the user is one of those people who won't wear rubbers, no matter what the weather, the handle can be used as a container for cigars, cigarettes, candy, or cough medicine.



Maybe You Just Have To Get Used To It

NO, THE ladies aren't going to a masquerade. They are just demonstrating what the glasses of tomorrow may look like. New York fashion experts claim that glasses can be a beauty and fashion aid if properly accented with clothes, hats, coiffure and make-up. We're a mechanix magazine and not supposed to know much about these things, but if the girl of tomorrow is going to wear these goggles, we are all for the girl of today.

You're RIGHT—That's WRONG!

Here are 25 statements, some of them true, others false. The trick is to separate the *true* statements from the *false* ones—and it isn't as easy as it looks! Use a pencil or pen and check the correct box under each statement and see how you make out.

After you've given yourself the test, [illegible] and other members of the family and compare scores. They'll enjoy it and so will you.

Are you ready? Let's go!

1. The term "U-boat" is taken from the German word "Unterseeboote."

   True ☐ False ☒

2. World records show that a two man bobsled goes a great deal faster than a four man bobsled.

   True ☐ False ☒

3. A meteorologist is a person who makes a business of identifying and collecting meteorites.

   True ☐ False ☒

4. If, when eating dinner, you said, "Pass the hydrogen oxide," you would expect to receive the water pitcher

   True ☒ False ☐

5. A new born baby has more bones than a full-grown adult.

   True ☐ False ☐

6. It is absolutely impossible to train homing pigeons to forget their natural instincts and fly at night.

   True ☒ False ☐

7. A paravane is a device used by navies to cut mine wires and other underwater obstructions.

   True ☐ False ☒

8. A thermel is a small thermos bottle.

   True ☐ False ☒

9. Artificial wool from cow's milk is now being manufactured on a large scale, in Italy.

   True ☐ False ☒

10. Silicosis is the condition that is brought about when a person inhales too much laughing gas.

    True ☐ False ☒

11. When traveling under water, submarines are driven by electric motors.

    True ☒ False ☐

12. We think of the airplane as a comparatively recent invention, but Leonardo da Vinci designed a flying machine way back in the 15th century!

    True ☒ False ☐

13. The milky fluid obtained from a rubber tree is known as chicle.

    True ☐ False ☒

14. Samuel Finley Breese Morse, as well as inventing the telegraph, was one of the founders and the first president of the National Academy of Design.

    True ☐ False ☒

15. The affliction known as "bends" is caused by overeating.

    True ☐ False ☒

16. The eggs of bats make very good eating when properly prepared by a good cook.

    True ☐ False ☐

17. Pitchblende ore yields the very valuable element of radium.

    True ☐ False ☒

18. Automobiles in most European countries are taxed according to their horsepower rather than their weight.

    True ☒ False ☐

19. Your house gas meter registers the amount of gas you use in terms of poundage.

    True ☐ False ☒

20. An airplane pilot would rather take off with the wind than into it.

    True ☐ False ☒

21. The largest planet in the solar system is Jupiter.

    True ☒ False ☐

22. The duck-billed platypus is a small bird found off the southeastern coast of the United States.

    True ☐ False ☒

23. The starboard is the left side of a boat.

    True ☐ False ☒

24. "Sand hogs" is the name given to tunnel and caisson workers.

    True ☐ False ☒

25. A [illegible] press is used to press soldiers' trousers.

    True ☐ False ☒

WHAT'S YOUR SCORE?

To get your score, simply give yourself 4 points for every question you answer correctly and total the result. If your mark is above 90, you are exceptional; if it is between 80 and 90, you deserve high praise; if it's between 70 and 80, you're good; between 60 and 70, fair; and below 60—well, try again next month!

Answers will be found on page 125

Skiing Like Flying With Bat-Like Cape

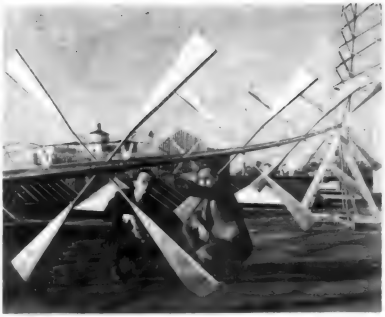
LOOKING more like a bat than a man, this skier is demonstrating the sail-cape. It serves alternately as a sail and as a brake, and in the former capacity is said to give the user the same sensation as a flight through space. To protect the skier from windburn, a hood envelops his entire head, leaving free only the mouth and nose.

"Vacuum Cleaner" Unloads Bulk Grain

FINDING the usual methods of unloading grain too slow, a brewery now uses air pressure to do the job. An operator is shown handling the nozzle of the metal hose like a vacuum cleaner. Below: The gentleman is pointing to a small glass window at the blower valve through which can be seen the loose malt being blown into the brewery's storage bin.

It Would Make A Swell Fan, Too

IT LOOKS like a new-fangled kind of windmill, or at least a trick water turbine—but don't let appearances fool you. It's an unusual aerial designed for W6XAO, the only television transmitting station in Los Angeles. The aerial is 60 feet high, and the paddle-like elements are intended to produce television pictures with better definition than former aerials have given. Made of duralumin-um, it is being inspected by Harry Lubcke, its designer, and Thomas Lee, who owns the station.



There's Still Room For The Fireman

WARTIME scarcity of gaso-line, or "petrol" if you're English, has caused Britain's in-ventors to work overtime per-fecting cars which will run on other substances. This car, seen in Worcester has been adopted to run on anthracite. The car is first started with petrol, and after about two minutes running is switched over to the anthracite. Consumption, it is claimed, is about 120 miles to a bag of anthracite.

Tillie The Toiler Should Try This One

SEEMINGLY still pleased with it, Mrs. Charles Fortier, of Milwaukee, inspects the odd-looking machine she used to pound back in the days when she was the world's first typist. Daughter of C. Latham Sholes, the man who invented the type-writer, Mrs. Fortier was the guest of the New York League of Busi-ness and Professional Women at their celebration of 100 years of woman's progress, recently.

Riding The FROZEN FREIGHT

A powerful Diesel-engine tractor hauls a lumber "train" in northern Manitoba. A water tank is pulled behind tractor to "ice the tracks" when going is rough. Below: Off on a long trip!

by James Montagnes

THE time was midnight, the temperature was 30 below zero, and the icy trail across the lake was covered with a thin carpet of finely powdered snow.

The noisy grumble of the tractor reverberated through the icy stillness, its headlights piercing far into the night. Behind the blazing lights sat the tractor driver, his eyes glued to the trail ahead, his mittened fingers clutched tightly around the wheel. Behind him trailed three heavily loaded sleds. Mining machinery, lumber, and provisions, valued at tens of thousands of dollars, was being hauled by the powerful tractor to a mining camp nearly 200 miles north of Hudson. Behind the three sleds was a box-like sled, the caboose of the tractor train. Inside were three sleeping men, a cook and two spare drivers. The whole outfit was moving at three miles an hour across the ice of Lac Seul.

Snow drifts, slush pools below the surface, and sub-zero temperatures are but a few of the constant dangers that confront the men who drive the northern Canadian tractor trains.

Off to the mines! Notice the propelled cabin-sled being hauled on the fourth sled of the train. Below: "A heavy drag." Those transformers that are being carried weigh plenty!

They were on schedule, making good time considering the load, when for no reason the headlights went out. The driver tried to light them, but couldn't. The lights remained out. Only the stars lighted the white expanse of frozen lake and, in the distance, a tree-clad island. Lighting an emergency oil lamp carried in the cab, he went on, more slowly, his eyes peering ahead more cautiously.

Suddenly there was a gurgling, bubbling noise directly below the tractor. It sagged a little, settled deeper into the snow on top of the ice. The driver had had similar experiences; he knew what had happened. With the first sound from below, he let out a yell, to waken the sleeping crew in the caboose. Then he jumped out of his cab, a second too late. As the tractor settled more quickly, his foot caught in the tractor belt. Tugging and pulling, straining and yelling, he loosened it a little, as the tractor settled more rapidly in the water-flooded snow. The headlights were already under water when the driver finally wrenched his foot free and threw himself into the snow. Down went the tractor and the heavily loaded sleds with it, as the ice crack widened and finally gave way.

In the caboose that first yell had wakened the three men. They always slept with one

The upper picture shows five sleighs and a caboose being hauled across a floating bridge over the Manowan River, near Senmaur, Quebec. Directly above, a tractor train is passing the Hudson Bay Company's post on its way to Val D'or gold mines.

ear open, and could hear the faintest noises of trouble even though the door of the caboose was closed and a stove burned to keep the cabin warm. With no time to grab clothes, the three rushed for the door. The first two jumped out, landed safely. The last man was nearly too late—he got out of the caboose, but he couldn't move.

The three men in the caboose had come out in their underwear, the driver's clothes were soaked from his struggle to free his foot from the sinking tractor. It was thirty below zero. The nearest island was a mile away. They had no food, no dry clothes. They managed to salvage a floating can of kerosene from the wreck, then hurried to the island, dragging the injured man between them. On the island they made a fire with their kerosene and the emergency matches carried by the driver. They kept a roaring fire going after making camp in the shelter of a clump of trees. They kept warm despite the temperature and their lack of clothes. But they didn't dare fall asleep.

Next morning they planned how to get the injured man to Hudson. They were on a traveled route: planes flew over it, tractor trains came by at infrequent intervals. Then they heard a plane. Out on the ice the three men dashed in their underwear. A thousand feet up was a plane, heading north. They danced on the ice. They waved their arms and shouted.

The man in the plane saw them. The plane dipped, wheeled, and came down, landing on its skis. In it was a doctor, northward bound. He attended the injured man, and the pilot took aboard the four men and flew them south to Hudson. The men had been saved from

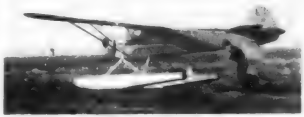
[*Continued on page* 122]

Land Looks Good To Seaplane With Skid

SEAPLANES need no longer be confined to water when landing or taking off, thanks to this new type of pontoon with "skid" arrangement. The pontoons are equipped with both wheels and an unusual "skid" in front. Made of strong but flexible metal, the skids keep the plane from tipping over.

The Cows Like It, Too

BRITAIN, expecting every girl to do her duty, is training an army of city girls to make themselves useful on the farm. Before being turned loose on defenseless cows, the girls must first practice on dummies.



Looks Like A Jitterbug

BUT she's not. She is testing her side vision with the aid of a waggling forefinger and a perimeter. The latter is the newest scientific device to measure the entire field of vision. A normal person should be able to see a moving object at a 90 degree angle while looking straight ahead.

Try It On Your Tennis Court

THE world's largest steamroller, weighing 20 tons, is being used in the construction of an English reservoir. The wheels of ordinary rollers sank into the soft soil of the reservoir wall, so this giant, with rear wheels 12 feet in diameter, was designed to overcome the trouble.

Lone Sailor Foils Davy Jones

GUY AVERY, 35-year-old Tampa, Fla., adventurer, was hauled aboard the Italian freighter *Belvedere* 550 miles west of Gibraltar when his 18-foot yawl, *Miss Tampa*, in which he was making an Atlantic crossing alone, was on the point of sinking. Avery, who had been at sea almost five months, was in a dazed condition and so weak from hunger he could hardly stand.

Smokes Without Glow

A HOME-MADE aluminum shield with vent holes enables this English air raid worker to enjoy his cigarette and obey the "Lights Out!" warnings.

Byrd Hasn't The Only Snow Cruiser

A NORTHERN Wisconsin winter is a mighty cold proposition, and the sub-zero temperatures often mean that baby has to stay indoors all day. This Tomahawk, Wisconsin, mother solved the problem nicely with an anti-blizzard sedan made of plywood, and equipped with windows and tiny port holes for proper ventilation.

It Takes The Dutch To Beat The Dutch!

THE Dutch army recently held unusual maneuvers —they tried to penetrate their own flooded frontier territory with tanks and armored cars. As the picture below shows, the result was complete failure, with cars and tanks bogged down in the muddy waters.

Airs, Kills, And Feeds!

THAT innocent looking ventilator at the top of the fish store's window isn't all it seems to be, as thousands of flies have found out. The flies, attracted by the light above the ventilator, are electrocuted by an electrified wire grill, then drop into a tank of goldfish where they are really appreciated.

WANT TO BUY A

Left: A healthy looking rattler, caught with the long-handled wooden tongs, is about to be deposited in a gunny sack which is hung in the branches of a shrub. Above: Joe King forces the snake's jaws apart, preparatory to the ticklish operation of removing the creature's deadly fangs.

by Harry Pederson

MAN chooses many strange ways to earn a living, but few are more precarious than the profession William King of Brownsville, Texas, has been at for thirty-five years —catching and marketing live rattlesnakes!

Of all the creatures that inhabit the United States, perhaps the most dangerous and dreaded is the rattlesnake. With one lightning-swift stroke of his gray head he can inject enough venom into a man to kill him in a few hours. He is so beautifully camouflaged by nature that it is almost impossible to see him when he is lying still, and although he usually sounds his warning before he strikes, his victims often do not see him until it is too late to escape.

Thirty-five years ago, William King decided there was money to be made if he could provide zoos and snake acts and circuses with rattlesnakes to show their customers. Today he is known to the show world as "Snake" King, and the King establishment at Brownsville is one of the largest commercial reptile farms in the world.

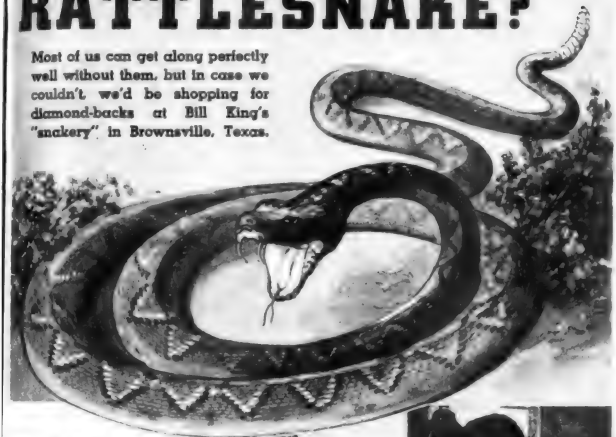
Catching snakes is no job for amateurs. The trappers who work for King have learned their jobs thoroughly—they *have* to if they want to stay alive—and they will teach their methods to their children.

For instance, there is Fructoso Cortez who has been catching snakes for King for more than twenty years. He can spot good snake country as he passes through it in a car, and he can tell by a snake's trail in the dust how large it is, what species, which way it was going, and whether it was frightened or merely traveling in search of food.

The equipment he uses is very simple. If he is working near camp he often employs a pair of long-handled wooden tongs with padded jaws to grab the snake just ahead of

RATTLESNAKE?

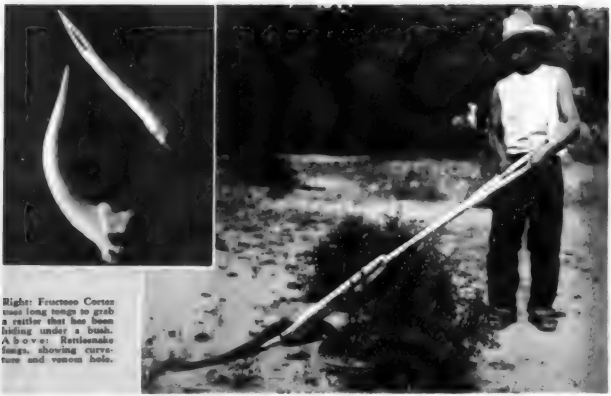
Most of us can get along perfectly well without them, but in case we couldn't we'd be shopping for diamond-backs at Bill King's "snakery" in Brownsville, Texas.



Joe King is about to remove the fangs from this rattler. He clamps its body with his legs to keep it from lashing about

its middle. Or he may use a stick two-thirds the length of a billiard cue with a slip noose at the end; or perhaps nothing more than a forked stick with which he holds the reptile until he can grab it and flip it deftly into his snake bag.

It all looks absurdly simple, but it is so only because he knows his job. He is taking chances with his life and he knows it. The forefinger of his left hand is only a stump, the result of a little accident. He was a trifle careless one day and a snake caught him in the finger-tip. He was twenty miles from a doctor. He knew of nothing to do but what he did to save his life. Before the venom could get into his blood stream he placed the finger against a tree and with his machete whacked it off.



Right: Fructoso Cortez uses long tongs to grab a rattler that has been hiding under a bush. Above: Rattlesnake fangs, showing curvature and venom hole.

In good country a snake catcher can bag three or four rattlers a day averaging six or eight pounds each. The largest one ever brought to the King snake farm weighed twenty-eight pounds and measured seven and a half feet, and while snake catchers tell fabulous stories of the huge snakes they have seen, "Snake" King has a standing offer of one hundred dollars a foot for any rattler measuring ten feet or more. No one has ever collected.

When the snakes are brought to the snake farm they are weighed and paid for by the pound, at a rate varying between twenty and thirty cents. King's son, Joe, usually handles them now because his father has taken to training lions. He scoops them unceremoniously out of the box or bag in which they came and tosses them into dens with double mesh fronts.

A few days later after the snakes have become used to their surroundings and have fully recovered from any injuries they may have received at the hands of the snake catchers, he removes their fangs and drains their venom sacs—probably one of the most dangerous jobs in the world.

It is all very easy when you see it done. He pulls a six-foot rattler from its box and using only his hands and a metal-pronged snake stick carries it to a bench at one end of the room. There he puts it down for a moment, and suddenly with a cat-like movement he has grabbed it just back of its head. Pressure of his fingers at the base of its jaws causes the mouth to open and expose the long curved fangs with syrupy venom dripping from their hollow points.

When it strikes, a rattlesnake lashes forward with its upper coils, and at the end of the stroke its head snaps downward like the cracker on a whip. It is this last movement that sinks the fangs into the victim. And since the hollow bases of the fangs are upon the venom sacs the sudden pressure of the blow forces venom through them into the wound.

To remove all of the venom Joe pushes against the venom sacs in the roof of the snake's mouth with a small blunt instrument. Adult rattlesnakes carry about two hundred milligrams of venom, and a lethal dose for a man is calculated to be one hundred fifty milligrams. The extracted venom is the color and consistency of corn syrup. When it has been dried to crystal form, the Kings sell it to chemical laboratories and research institutions where it is used in the preparation of anti-venom, a substance employed by doctors to fight the effects of rattlesnake bite.

Joe King will not reveal the exact method he uses for extracting the fangs because that is a King secret. But he does it very quickly with a scalpel and a pair of tweezers while he holds the deadly jaws apart with one hand.

[*Continued on page* 126]

Bug Catching Method Like Old Style Snipe Hunt

EMPLOYING light bulbs as their only weapons, scientists at the University of Minnesota are fighting an experimental war against insect hordes to make America safe for its farm crops.

Along one battle front on the farm campus, a row of ten bug traps has been installed. These look like open air birdhouses with round, sloping roofs and deep, dark cellars. An electric light bulb is installed in the center of each house, and metal fins radiate outward. Attracted at night by the glowing bulb or mercury vapor light, the bug zooms headlong into the trap and is deflected into the cellar where a fumigant ends its troubles. In the cellar floor is a hinged trap door through which the bug jar can be removed hourly and contents counted, sorted and classified.

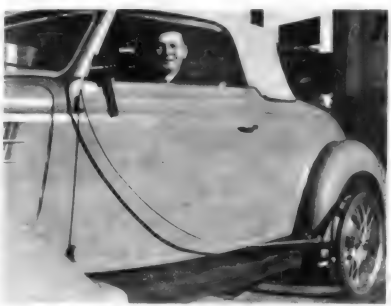
Each trap contains a different colored light, and by maintaining accurate counts, warring scientists determine which lights are most effective, what sex and species of bug flies at certain hours, and how their period of flight compares with air and soil temperatures.

To measure the flow of current to the lights, special meters are used, and lights are turned off at a predetermined hour by means of a clock-like gadget.

[*Continued on page* 126]

Not How Fast But How Far

ACCURATE as a tape is the apparatus at right, known as a survey footometer, which registers in feet the distance traveled by an automobile. It consists of an indicating instrument which is clamped to the car door and is driven direct by a flexible shaft connected with the bicycle wheel which is fastened to the running board. Accuracy is secured by having a minimum of air pressure in the tire, thus eliminating wheel bounces.



EFFICIENT NEGATIVE FILE

Above: The file print is projected as shown. Negatives are placed on enlarging paper, emulsion to emulsion and covered with a sheet of glass to hold them in place. Negatives can be dodged. Left: Showing the file print.

by Murray Knowlton

USUAL methods of recording the popular 2¼x2¼ size negatives tend toward complicated and involved procedure, but the following system works out with a minimum of "fuss," yet fills all essential requirements of such a record.

In effect, six of the square negatives are printed together on 5x7 paper and filed. Subject headings, film numbers and whatever additional data desired, is written directly in a space provided for that purpose. To find a particular negative it is only necessary to thumb through the file for the subject heading and refer to the number of the corresponding film file. Negatives are not pawed over every time a particular one is wanted. A complete record of every photograph taken is instantly available.

Although the details apply to the 2¼x2¼ negative size, there is no reason why they cannot be adapted to other sizes, including 35 mm.

As three negatives in a strip just fill the 7-inch length of the record print, whenever possible a roll of film is cut into four strips of three negatives each. In cases where a variety of subjects are one roll the individual negatives can be cut apart and rearranged with only a slight amount of additional work.

Two of the film strips, six negatives in all, are placed in contact with the paper and printed, either by contact or with light from a projection enlarger. The latter method has a few advantages. The film strips are easier to arrange. Individual negatives can be dodged or "burned in" if they are under or over exposed.

By either method the blank white space for recording data on the multiple print is made by inserting paper cut to the desired size between the print and the light source.

When the record print is finished and dried any data is written in the space provided, plus a file number. This file number corresponds to an identical number on the negatives, whether they are put away in envelopes, book files, or any other filing device.

A record of a full role of 12 negatives can be made in the time it requires to make two contact prints. A check on every negative in the system is instantly available. Regulation file drawers will hold the records or they can be stored in suitable containers.

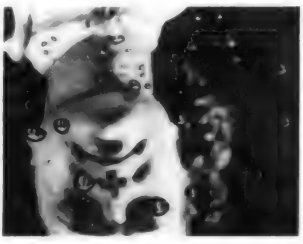
WATER DROP REFLECTIONS

A DROP of water, performing the function of a lens, will reflect an illuminated image provided there is an appropriate adjustment of both subject and camera in relation to the water drop. The illustrated exposure set-up tells the whole story. The surface upon which the water drops are spilled is horizontally placed in order to achieve drops as round as possible, the illuminated subject is bent over the surface, and the camera, equipped with ground glass for careful focusing and arrangement, tilted at the required angle to provide the reflections.

Although any similar surface may be used, the water drop support employed in making the picture shown was a chrominum-plated ferrotyping tin, the subject being lighted on one side by spotlight, on the other by diffused flood-lighting. The illumination should be kept away from the reflecting surface.

Some distortion is, of course, unavoidable, and the reflections will be inverted in the same way as a photographic lens inverts the image it receives. For this reason, the finished photo is reproduced with the reflected head upside down so that the water-drop reflections may be seen right side up.

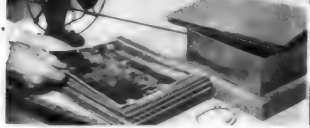
Above: The model is posed over the tray while the photo is taken of the reflection only. Finished print is below.

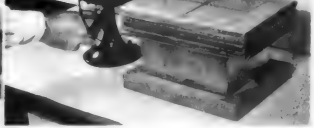


Cardboard Sandwich Dries Print

A SIMPLE photographic print drier consists of a pile of corrugated cardboard pieces, with the prints sandwiched between. The cardboard should be somewhat larger than the largest print to be handled; the corrugations should all run the same way.

Prints are blotted to remove excess water, before placing between cardboards. They dry perfectly flat. When the pile is placed in front of an electric fan so that air is forced through the corrugations, they can be dried in a surprisingly short time. Use clean cardboards free of wavy surfaces that might affect the print.

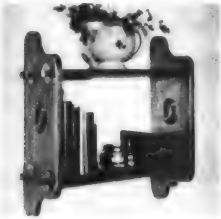




How to Build SECTION

PICK YOUR PROJECT

Illustrated on this page are some of the things you can build from the plans and instructions given in this section. Select the one or ones that appeal to you, turn to page indicated.



Knock-Down Portable Shelf. Ideal one-evening project. Turn to page 105.

Marine Lamp and Porthole. Make them this winter for your summer cottage. Page 102.

Antelope Ornament. Decorative walnut statuette for craftsmen. Page 104

Modernistic End Table. Handsome, useful and easy to build. Plans on page 99.

Oil Drum Stoves. More heat from less fuel with these ingenious ideas. Also complete oil drum heating units. Page 98.

Make Your Own Sailboat Fittings from solid brass. Patterns and instructions are on page 100.

Carve Yourself a "RUBAIYAT"

Fast, Class "A" Model Racing Sloop

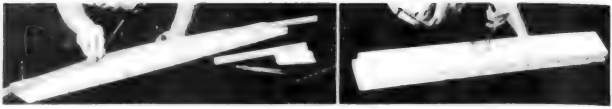
by E. H. Vogelpohl

Rubaiyat!
An idle hour, a tangy breeze
And thee
Upon the briny sea
Is paradise, indeed,
For salty lads like me.
OHMY KYACK.
(apologies, Omar)

NO SPECIAL skill or experience in wood carving is necessary to create a very fine duplicate of "Rubaiyat" but patience and infinite care are virtues which will reflect themselves in exquisite workmanship. A ten-dollar bill will cover the cost of lumber, fabric, paint and hardware, but when finished you will have something worth ten times more.

The bread-and-butter or laminated type of construction was chosen for "Rubaiyat" because of the comparative rapidity with which a seaworthy model may be constructed by this method. Too, the weight of the finished model with sides as thick as ¼-in. will be only a few ounces heavier than a planked model of the same size. This bit of excessive weight is not as great a handicap in racing

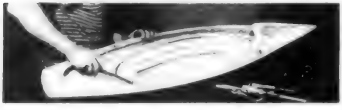
Her mast stands six feet high, and she spreads a good bit of sail, but ten pounds of lead in her keel give the necessary stability.



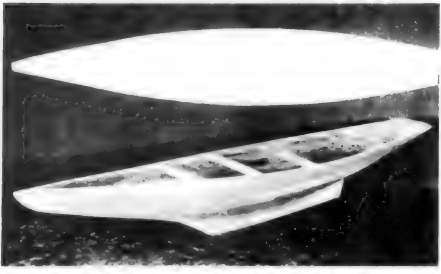
After marking off the station with belt lines around each plank, the water lines are laid out on the lifts by means of a batten bent around pins stuck in the wood at the correct spots. The two halves of each lift are screw fastened together for jigsawing.

Jigsawing the lifts, two at a time. Cuts must be made *outside* the pencil lines, which should be left visible at all times. After cutting, the halves of each lift are joined at the ends by marine or casein glue and clamped securely until dry.

Next step. Completed lifts are laid sandwich fashion, very carefully on top of one another and glued together. Clamps hold them tightly while adhesive is setting.



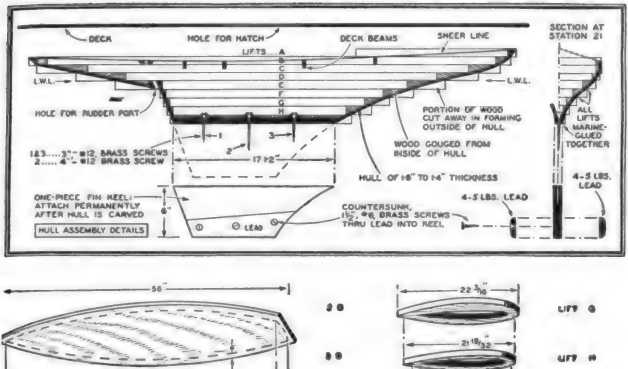
After the outside has been planed to shape the inside of the hull is gouged out until the wood is approximately ¼-in. thick all over.

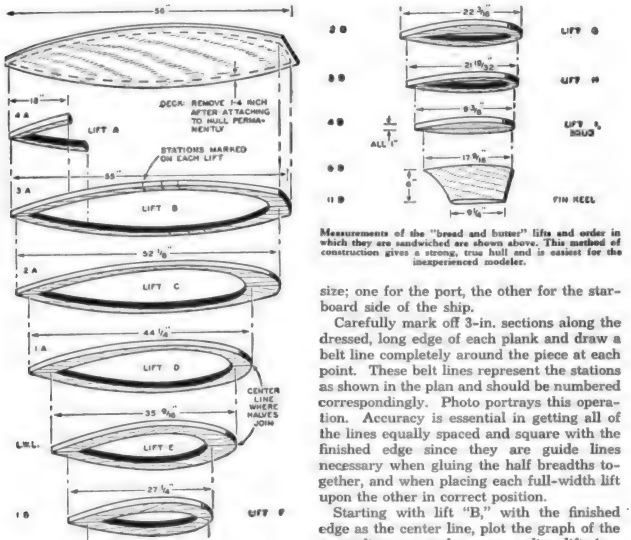


The completed hull, with deck at top. Final smoothing down is done by careful sanding, checking the contours with templates at frequent intervals.

as may be expected since, more often than not, races are won by the skill with which a skipper handles his ship.

The first step is to get forty-two feet of clear, straight, white pine boards, one inch thick and 4¾-in. wide. These are all standard dimensions, the forty-two feet being three standard, fourteen-foot lengths. Have the lumber finished nice and smooth on both broad surfaces and sand one long edge straight and smooth



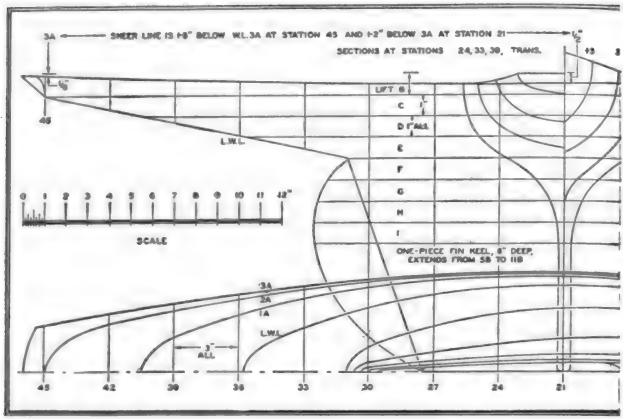


Measurements of the "bread and butter" lifts and order in which they are sandwiched are shown above. This method of construction gives a strong, true hull and is easiest for the inexperienced modeler.

Then cut up lumber into lengths corresponding to the lengths of the various lifts or laminations plus one inch. That extra inch provides for a half-inch margin at either end. Remember, there are to be two pieces of each size; one for the port, the other for the starboard side of the ship.

Carefully mark off 3-in. sections along the dressed, long edge of each plank and draw a belt line completely around the piece at each point. These belt lines represent the stations as shown in the plan and should be numbered correspondingly. Photo portrays this operation. Accuracy is essential in getting all of the lines equally spaced and square with the finished edge since they are guide lines necessary when gluing the half breadths together, and when placing each full-width lift upon the other in correct position.

Starting with lift "B," with the finished edge as the center line, plot the graph of the water lines on each corresponding lift (see figure 2) and draw in the sweeping curve by means of a batten bent around pins stuck into the plank at the offset points at each station. This operation is being performed in photo 2. The offset points are obtained by measuring the distance from the center of the boat to the



particular water line at each station. For this detail consult the plans above.

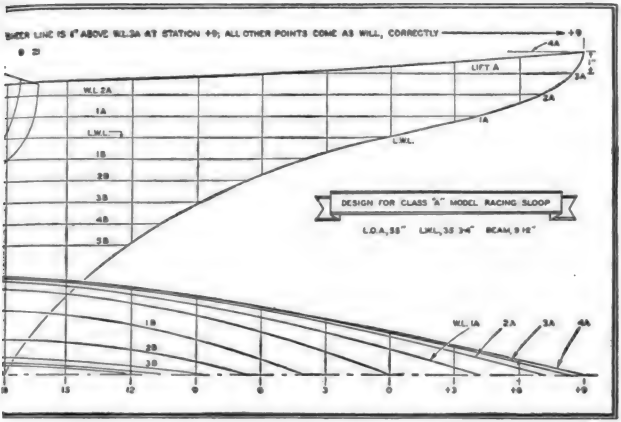
Let us assume that you have the water line 3A drawn on lift B. Then, on the same plank, draw the water line immediately below it, in this case 2A. Use a dash line to make the distinction obvious. Next, and still on the same plank, draw another curve representing the inside surface of the hull. This curve is not critical since the precision job of gouging out the hull later would nullify any painstaking care with it. However, do not let this third line come closer than ⅜-in. to the dash line anywhere. As you can see in the photos its distance from the dash line grows greater at each end to allow for a little more thickness of hull at the points where the model will receive the most bumps.

Place this plotted lift on the other half of lift B, line up the stations *exactly* and temporarily screw-fasten the halves together with five, 2-in. No. 2 screws preparatory to cutting them to shape.

Repeat this cycle of operations and details with each pair of lifts and you will be ready to cut out the laminations on a band saw, two at a time. Do not saw directly on the lines but rather let the blade just "kiss" them lightly. And remember . . . to lose the line at any point is a capital crime. No cutting is to be done along the dash line; it being merely a necessary construction line for establishing the third, or inside line. It will also aid in assembling the finished lifts, later. Note please that lift "I," the smallest one, is *solid*; not cut out in the center.

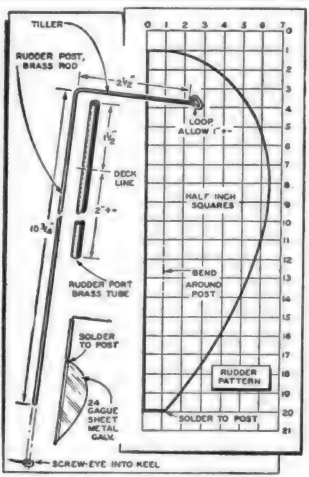
After sawing, the bow ends of the lifts will be very narrow and thin. Take great care not to damage them in handling since a nick or a dent would necessitate the use of plastic wood or result in the loss of that beautiful flow of line so carefully worked out in the profile.

Each pair of halves may now be joined with marine glue or casein glue as second choice. First separate a pair of halves, then replace screws at each end of both halves so that they project beyond both surfaces. Proceed by sanding, touching surfaces lightly, apply marine glue, bring both halves together so that the ends and the midship station line, number 21, line up exactly. Two small clamps at each end, one on top the other at bottom, bear on the projecting ends of screws while glue is drying. Two additional large clamps, one at each extremity, provide the even pressure necessary for a good joint. Place little wooden wedges between the lift and the large clamps to keep the latter from slipping and to prevent clamps from biting into the lift. Allow plenty of time for the glue to dry and set before removing clamps.



Sand and spread marine glue on the touching surfaces of the various lifts which are then placed one upon the other in their *precise*, relative positions to form the rough mass of hull. While doing this you will understand vividly why this technique was dubbed the "bread-and-butter" method. Line up center lines and check the station lines for perfect alignment. Watch out that the lifts do not slip when clamps are applied. If your clamps are not large enough to grasp all of the lifts at once, glue up the five bottom lifts first and when glue is dry attach the remaining four upper lifts to this assembly as illustrated.

Now the hull is ready for carving. Secure it fore and aft with cleats attached to the work bench. A good draw knife is the handiest tool for taking off the greater excess of wood from the outside of hull. Carve in long sweeping strokes until the joints of the lifts are just reached. Then *stop*. After both sides of the entire hull have been roughed out in the above manner carefully proceed to finish with a plane and No. 2 sandpaper. Patience and care are essentials from now on. Do not cut into the water lines and keep the center line straight. Your sense of touch while sanding will reveal irregularities in streamlining quite as readily as your eye. After one side of the hull has been finished to perfec-



The sheet metal rudder is cut to shape from pattern above, which must be drawn full size. It is soldered to the rudder post, but not until after installation.

tion duplicate the contours at stations on the other side by checking with templates as shown in photo 9; the numbered, station lines are still showing on the top and bottom surfaces of lifts B and I respectively. Use the section lines in the plan (figure 1) as standard patterns for templates. On the lower lifts; the top ones, though, when hull is upside-down in working position; the sections are concave and your carving must be done with gouges of several sizes. Shave carefully, patiently removing each thin curlicue, a little at a time.

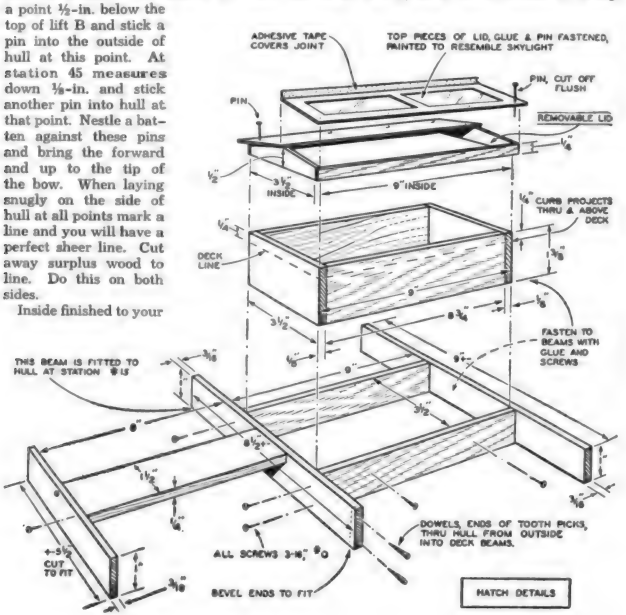
Scooping out the inside of the hull is the next step. In our model the thickness will be ¼-in. Rough cutting is done with gouges; finishing with No. 2 sandpaper. Calipers are used to maintain a uniform thickness.

Mark the sheer line on each side of the hull as follows. At station 21 mark off a point ½-in. below the top of lift B and stick a pin into the outside of hull at this point. At station 45 measures down ⅛-in. and stick another pin into hull at that point. Nestle a batten against these pins and bring the forward and up to the tip of the bow. When laying snugly on the side of hull at all points mark a line and you will have a perfect sheer line. Cut away surplus wood to line. Do this on both sides.

Inside finished to your satisfaction, install the deck beams and connecting hatch members, etc. Fasten with glue, pegs and screws (see figures 4 and 7).

Bore the ¼-in. hole for the rudder port through the hull with a brace and bit. Line up the bit both ways with the straight, aft end of the keel so that the job will be true and at the correct angle. Continue hole up to and through the aft deck beam. And later, when ready, through the deck. Flow shellac into the hole in bottom and drive in the port at once. There should be a tight fit to prevent leakage.

Cut profile of the fin keel from an 18x6-in. piece of pine 1-in. thick. Draw water line 5B on the top surface and streamline to this line with bandsaw or plane. Finish with sandpaper and attach to hull with marine glue. Reenforce with three, round head, 3-in. No. 12, brass screws driven in through



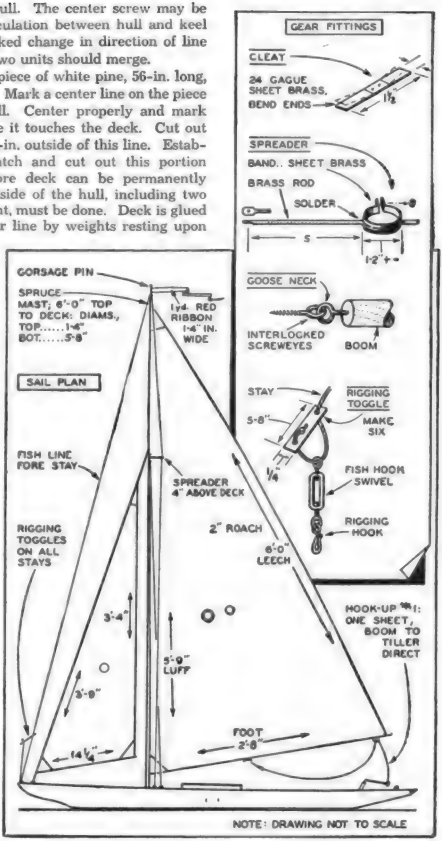
lift "I" from the inside of hull. The center screw may be longer if desired. The articulation between hull and keel should be smooth. No marked change in direction of line should be noticeable. The two units should merge.

The deck is cut from one piece of white pine, 56-in. long, 10-in. wide and ⅛-in. thick. Mark a center line on the piece and impose it upon the hull. Center properly and mark around the sheer line where it touches the deck. Cut out deck piece roughly about ¼-in. outside of this line. Establish the position of the hatch and cut out this portion directly on the line. Before deck can be permanently attached all work on the inside of the hull, including two coats each of shellac and paint, must be done. Deck is glued to hull; held tightly to sheer line by weights resting upon it while glue is drying.

When glue is set trim deck nearly to the hull with a plane. Finish flush with a sandpaper stick. Attachment may take place either before or after the outside of hull has been treated to its first undercoat of paint.

In all, the outside of hull is given two coats of good shellac and three of paint, sand lightly between coats. The choice of colors is yours. The deck is spar varnished as is the hatch cover of cigar box wood. Make your spars, sails and rudder while paint is drying. These details are fully explained in the drawings. Remember, however, that the rudder is soldered to the rudder post *after* being installed in boat. Be careful not to destroy the fore and aft balance of the boat when attaching the ten pounds of lead to the keel.

For best sailing there must be a balance between the centers of effort and resistance. Since our center of lateral resistance is a fixed factor in a hull of this type, the placement of the mast is an important factor. Trial and error alone will tell the best position for a particular, individual hull. In the original model the mast was stepped as shown in the sail plan and the little vessel gave a very in-



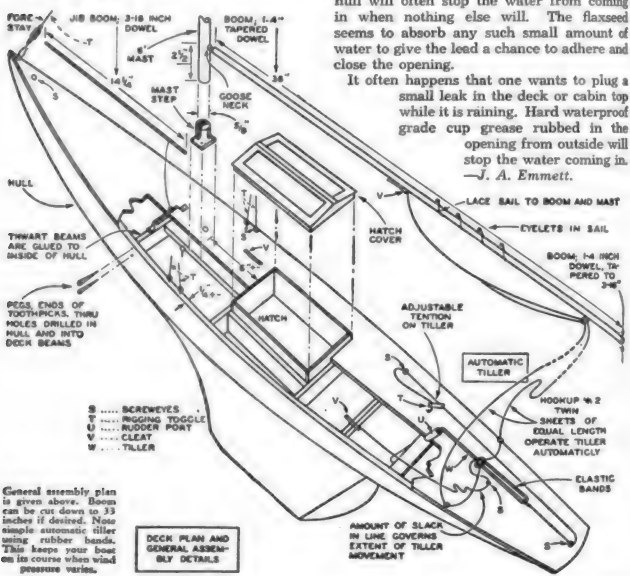
Sail plan and fittings. Fishline or piano wire can be used for stays, and deck hardware is cut from sheet brass. There is no mass of complicated gear as everything was designed from a standpoint of utility and simplicity.

teresting as well as satisfactory performance.

Complete blueprints for **Rubaiyat** *are available at $1.50 postpaid. Order by number (314) addressing Fawcett Publications, Inc., Greenwich, Conn., enclosing check or money order.*

BILL OF MATERIALS FOR "RUBAIYAT"

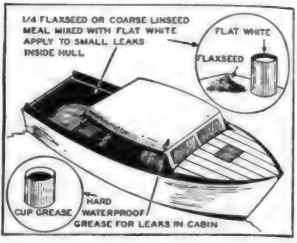
Hull: Clear white pine 42"x4¾"x1" exact
Keel: Clear white pine 18"x6"x1"
Deck: Clear white pine 56"x10"x⅛"
Mast: Spruce 6 0"x¼"x⅛"
Boom: Birch dowel 36"x¼"
Jig boom: Birch dowel 36"x⅛"
Deck beams, etc., White pine trim 6'x1"x¼"
Hatch cover—Cigar box cover
10 lbs. sheet lead
3—3", No. 12, round head, brass screws
12—⅝", No. 0, flat head, brass screws
1 dozen small screw eyes
3 hank heavy fish line
5 fish hook swivels (dummy turnbuckles)
1 sq. ft. 24 gauge, galvanized sheet iron
3 ft. copper tubing ¼" inside diam.
2" brass rod (to fit into brass tube)
1 mast step for ⅝" mast
½ lb. can marine glue
1 pt. clear shellac
1 pt. spar varnish
1 pt. outside white paint
1 pt. outside green paint
2 yds. bleached muslin
medium elastic bands



General assembly plan is given above. Boom can be cut down to 33 inches if desired. Note simple automatic tiller using rubber bands. This keeps your boat on its course when wind pressure varies.

DECK PLAN AND GENERAL ASSEMBLY DETAILS

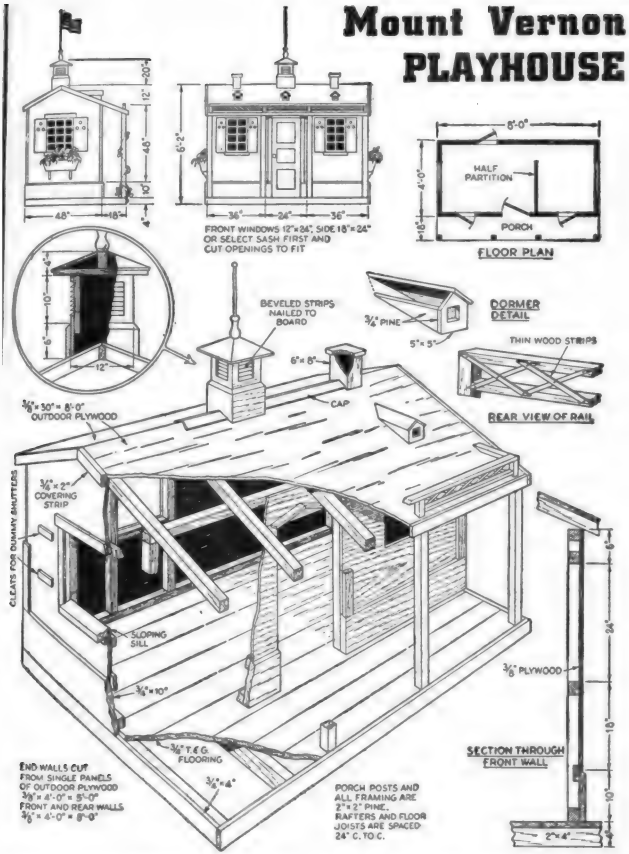
Stopping Small Leaks



TWENTY-FIVE per cent flaxseed or coarse linseed meal mixed with white lead and applied to a leaking water pipe connection or to small leaks or seeping places inside the hull will often stop the water from coming in when nothing else will. The flaxseed seems to absorb any such small amount of water to give the lead a chance to adhere and close the opening.

It often happens that one wants to plug a small leak in the deck or cabin top while it is raining. Hard waterproof grade cup grease rubbed in the opening from outside will stop the water coming in.
—*J. A. Emmett.*

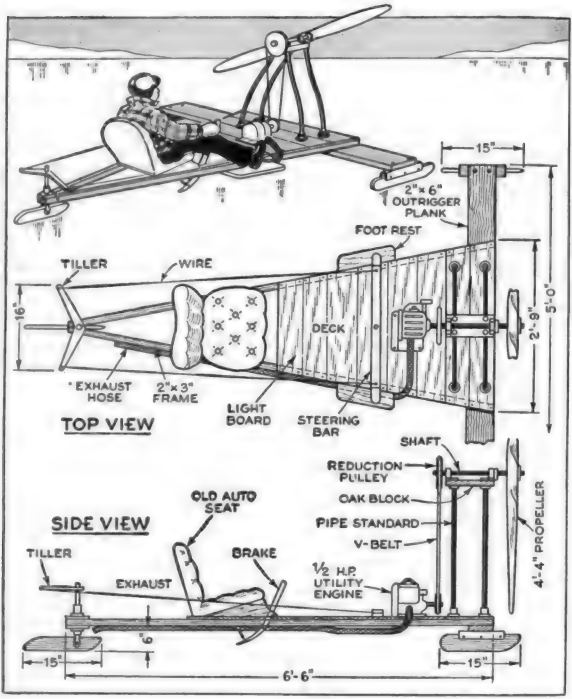
Mount Vernon PLAYHOUSE



THIS very much modified version of Washington's home on the Potomac has a double purpose: after the children have outgrown it you have a very convenient tool house for the garden. First of all, it is designed for simplicity of construction. Cupola, rail above porch, shutters and window boxes

[*Continued on page 132*]

"ICE LIZARD"



by L. B. Robbins

AIR minded, ice-boat and mechanically-inclined fans: here is something to arouse your imagination and ingenuity—an air propelled ice-boat using a washing-machine engine for power and capable of good speed and breath-taking thrills. Let's build a fleet of these "Ice Lizards" for the height of the skating season and give the populace something to talk about.

The body consists of an outrigger plank 5 feet long, 2 inches thick and 6 inches wide. To this are bolted two pieces of 2x3 finished stock, on edge, fanned out on the outrigger 2 feet, 9 inches. At the stern they are beveled to fit together, and bolted. The length of these 2x3's should be such as to make the

total length of the craft 6 feet, 6 inches over all. The outrigger forms the bow and the pointed end is the stern.

Next, plank over the body from the bow to within about 2 feet of the stern, with light matched boards. At the extreme stern end of this deck mount the seat. An old bucket seat from a discarded automobile will be just the thing. In lieu of this get hold of any single driver's seat from the auto junk-yard and tip it back about as shown, shimming its front edge up with triangular shaped pieces of wood under each side.

The two runners and the rudder are shown in detail. The latter should be made somewhat narrower than the runners to compensate for the additional iron-work below the body. By doing this the body will be supported horizontally on the ice. All three blades can be fashioned from sheet steel and measure 15 inches long. The front and bottom edges must be ground to a V edge and ground sharp. The rudder has a hole drilled somewhat forward and above center to which is pivot-bolted the fork in the bottom end of the rudder post. This latter can be made from ½ inch pipe with the top end filed square and drilled for a pin. A rudder post bearing is made from a length of ¾-inch pipe driven through a hole in the stern joint of the side pieces. Screw two wooden triangles to the top and bottom of this joint and then secure the bearing in place with pipe locknuts above and below. The height of the stern above the rudder can be adjusted by the collar adjustment on the rudder post as shown. The tiller is shaped and dimensioned as indicated and cut from flat steel. Drill a small hole in each wing and fashion a square hole in the center to fit and pin over the top of the rudder post.

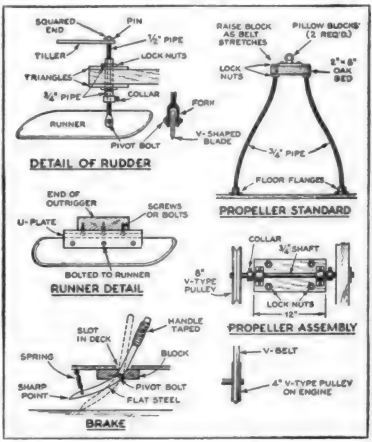
The runners, as before stated, are the same length as the rudder but wider. To the top edge is bolted a suitable length of channel iron which in turn can be bolted to the under side of the outrigger at each end. These are also V shaped and ground to a sharp edge along the bottom and front.

The steering-bar consists of a piece of hard wood a foot longer than the body at a position in front of the driver's seat, as shown. It should be pivot-bolted to the center of the body and its ends connected to the tiller by taut drawn steel wire. Small turn-buckles may be inserted if desired, to true up this steering system, as it is important that this be strong and easy operating during speed sailing.

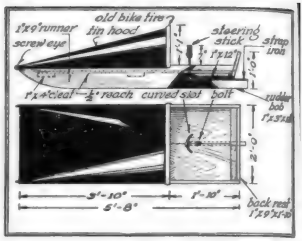
For braking purposes a simple drag is resorted to. This is a boomerang shaped piece of flat bar steel, taped at one end for the handle and the lower end ground to a point to dig into the ice. A slot should be cut in the center of the deck just forward of the seat and an oak block bolted below and to one side. The brake is then pivot-bolted to the block through a hole drilled in its bend. A spiral spring is then inserted between a hole near the point and the under side of the deck to hold the point off the ice. To brake it is only necessary to pull back on the brake handle and the point digs the ice until "lizard" comes to a stop.

Lastly, securely fasten two wooden footrests to the under side of the body and below the steering-bar as indicated. This allows the driver to rest his feet on these boards and at the same time press along on one side of the steering-bar or the other and direct the course of the craft.

[*Continued on page* 128]



Make This Snow Boat From Scrap Materials



MAKE the runners from one-by-nine boards, 5 feet 8 inches long, fastening them together with one-by-four cleats at the front and middle, 3 inches below the upper edges of the runners. Cover the cleats with half-inch floor boards, and nail a one-by-twelve across the rear end of the floor, between the runners, to support the seat. Nail a board 9 inches wide and 1 foot, 10 inches long at an angle between the runners at the rear, for the back rest.

The rudder bob is 1 inch thick, 3 inches wide, and 12 inches long, with a length of strap iron fastened with screws to the upper edge of the runner, and bent at right angles, the upper end of the strap-iron sliding in a curve slot cut in the floor as shown. Drill holes in the iron for the rudder screws, a large one for the bolt axle, and one or two in the upper end so that you can fasten boards on either side for the grip at the top of the steering iron, which should extend about 7 inches above the upper edge of the runners. Fasten washers between the strap-iron and underside of the floor, and grease them to permit the stick to turn easily.

Fasten large screw-eyes in the front ends of the runners, and make a pull rope with one end doubled and a harness snap fastened in each end, so that you can quickly snap them into the screw-eyes for pulling the sled back up hill. Carry the rope inside the sled going down. If posible cover the front of the sled with tin, to form the hood, bending it in the shape shown, and tacking it along the edges of the runners. Otherwise bend a length of strap-iron in a curve, bolting the ends to the sides of the runners, and drawing canvas or a cotton sheet over the strap-iron frame where it can be stitched in place. Tack the canvas along the edge of the runners. Tin makes the more durable hood, however.

Ice Tops

IF YOU have a lathe, these tops will be easy to make from hardwood. Otherwise whittle them from pine, using blocks 3 or 4 inches square at the end and from 4½ to 5 inches long. Plane down the blocks until they are square, draw a circle at one end of the block, and find the middle of the other end. The spindle top is whittled out in one piece. Make a circular saw cut 1½ inches below the top, leaving the center which you can whittle into the spindle after cutting away the surplus around it. Whittle the remainder of the top in a smooth cone shape. The other top is egg-shaped at the top, and fitted with a nail at the bottom, filed to a sharp point. To spin the egg top, wrap a six-foot [*Continued on page* 133]

Lead Skate Sheath

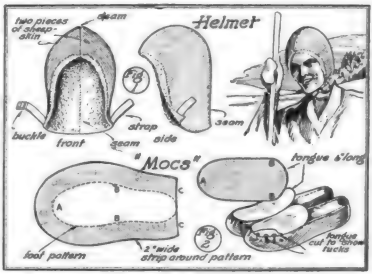
YOU can make this pair of lead sheaths for your skates and save much dulling. As you carry skates over your shoulder, or in your hands to and from the skating place, the keen runners often bump against each other. These little nicks thus caused often do much more damage than actual skating. The lead sheaths will protect the runners and keep

[*Continued on page* 132]

Sheepskin Helmet and "Mocs"

USE the sheep-skin lining from an old jacket or coat to make a set of "mocs" and a helmet for cold weather. The helmet fits snugly about the head and is fastened by a short web strap and buckle, such as a skate strap. It can be worn as shown, or with the wool turned on the outside. The "mocs" are just the thing to slip into on biting cold days, or when you first get up in the morning. Although not heavy enough for out-of-doors, they are warm and comfortable in the house.

Use a flour sack or stocking pulled over the head for the helmet pattern, pinning up the slack until you get it to fit snugly. Cut out the pattern from the sack or stocking, cutting down the center to form two pieces, and leaving a 2-inch margin around each piece which can later be trimmed away. Note how the front opening extends from the forehead, down across the cheek, and to the neck. Place the pattern pieces on the skin side of the sheep-skin, cutting them out. Lay the pieces together, wool outside, and with stout needle and heavy thread sew the two pieces together.

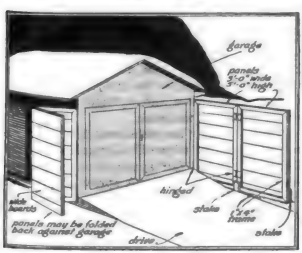


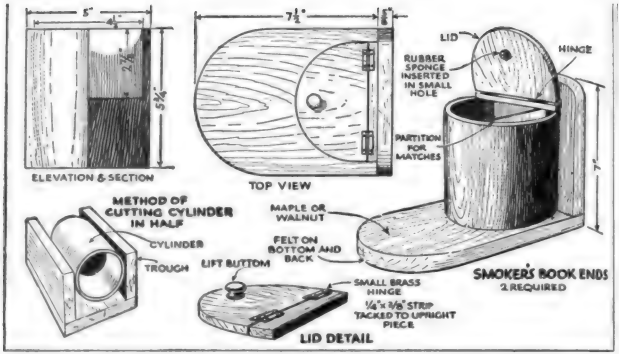
Before pieces of sheep-skin are stitched together in making helmet or "mocs," trim away a narrow strip of wool from the skin along the edge to be stitched. Pin the pieces together first, fitting it on the head, and taking up the slack, before doing the final stitching with thread. When sewn, turn the helmet with the skin outside, and stitch the short sections of strap to the lower part of the helmet so that it can be closed at the throat. Turn back the edge on each side of the face, stitching it down, to give a wool-trimmed effect around the face.

To make the "mocs," place your stocking feet on the skin side of a piece of sheep-skin and mark around the feet with pencil. Outside these lines mark the outside line of the pattern, making it 2 inches larger all around, except at the heel, which is cut square across. Trim out as shown. Cut out the two tongue pieces, making them the same as the outline of the foot at A, B, B. Fold up the front edge of the moccasin pattern, and take four or five tucks in the edge, gathering the skin together and stitching it as shown in the drawing. This draws up the sole to fit the foot. Stitch the tongues in place, sewing the edges of the skin together with over-and-over stitch. Turn the edge at the heel wool-side out, and stitch the edges C, C, together; then turn them back with the wool inside.—*G. E. V. H.*

Garage Snow Guards

KEEP drifting snow from filling the garage drive and banking against the garage doors by installing a pair of these folding panels or doors. When the doors are not in use, they can be folded neatly back against the side of the garage, where they are secured with hooks. Make each door about 3 feet wide and 5 feet high, using one-by-four boards, mitered at the corners, for the frame and covered with wide boards or matched lumber on the back. Fasten each pair of doors together with heavy hinges as shown, and fasten the panel adjoining the corner of the garage with another set of hinges. The extended doors are held in place with stakes.





BOOK ENDS FOR A MAN'S DEN

by Dale R. Van Horn

BOTH of these book end projects have sufficient novelty to make their construction enjoyable. Neither is expensive. The enterprising shop owner may see here a chance at some spare-time profits. Cost can be kept to a minimum on the smoker's book end by utilizing round walnut or other wood from the home wood pile. If you have none of your own, then a trip into the country will usually yield several pieces of walnut, maple or other appropriate wood which has pretty well cured while a dead tree still stood before it was cut down. Often minor checks seen on the surface go only a little ways into the trunk. When choosing such wood be sure to obtain pieces sufficiently larger than the project in mind to permit the turning away of all sap (white) wood so that only heart wood will show up in the finished piece.

As for the copper for the disc book ends, the best plan of course is to buy new sheet copper from the hardware store. The piece of thick copper for the head cutouts is small, and the four discs used to cover the maple discs can be of thin gauge, thus keeping the cost down. At a roofer's shop you may be able to pick up scrap sheet copper suitable for the purpose for only a fraction of the cost of new sheet copper.

Smoker's Book Ends: This project requires four pieces of flat stock, a turned cylinder of solid wood and a thin turned disc for the lids, with four tiny brass hinges and screws, a bit of wood scrap for hinge blocks, some felt for backing and glue.

Mount the stock for the cylinder on the face plate and fasten it firmly with long wood screws, leaving enough extra length for waste. Turn this down to 5 inches in diameter and 5¾ inches long; then sand smooth. Back the tail stock away and turn a depression 4½ inches in diameter and 2⅝ inches deep so that the lid will close when cigarettes are placed inside. If walnut is used, next fill the outside with paste wood filler to which has been added enough walnut stain to make it match the wood. Maple, gum and other close grained woods do not require filler. Maple stain can be used on white pine, however, to give a nice modern tone to the project. If this is done, cut the base and upright pieces from white pine also, and stain.

After the filler has remained in place for a couple of hours, wipe off all surplus with the lathe running at fair speed, then turn up to high speed and polish. A spray gun coat of clear lacquer will finish it nicely. When this has dried, dress down lightly with No. 000 steel wool, then give a coat of polishing wax. Remove the cylinder from the face plate,

turn upright and pour into the cavity a quantity of piping hot paraffine. Turn the cylinder slowly so that all parts of the sides and bottom are coated. The wax quickly penetrates the fibers of the wood, making them air tight. Then pour out the surplus wax. This turns the cavities into good humidors.

To saw the cylinder accurately in two, make a trough with bottom and sides from scrap lumber, not quite wide enough to permit the cylinder to touch bottom. This causes the cylinder to drop to a pinch fit between the sides. The trough is moved along a straight edge or fence on the band saw table, the blade cutting the cylinder through from end to end. Be sure to make a test cut or two so that one half of the cylinder won't be larger than the other.

Now run each cylinder half over the jointer, or a board on which sandpaper has been carefully glued, to true up the cuts and remove tooth marks. Turn a disc of the same 5-inch diameter ½ or ⅜-inch thick. Cut this into two segments which, when fastened to the hinge blocks, will line up with the cylinder segments. The hinge blocks are fastened with a screw through each end with the head countersunk. Or the head may be turned below the surface and a wood plug glued over it so the screws won't show.

Cut two pieces 7 inches long and two 7½ inches long for the bases and uprights. Cut the front ends of the base pieces to a full half circle, but merely round the corners of the upright. Nail and glue these together to form right angles. Their widths are 6 inches, their thickness, ⅝-inch. Finish these on the edges and exposed sides as you did the cylinder. Nail or fasten each cylinder half as indicated with screws and glue, making sure the joints are tight. Then cover book side and bottom with felt glued on.

A small hole can be cut into the under side of each lid, this paraffined and then a piece of sponge rubber edged in place so that it can be moistened when desired and thus prevent the contents of the humidors from drying out. The lift buttons are turned from scrap with a short tenon which is glued into a hole bored for it. If desired, a thin partition can be glued into one half cylinder to form a separate compartment for matches. One sketch suggests this.

An alternative design is to turn two identical cylinders and use two-thirds of each, thus providing greater capacity in each. If this is done, the cylinder diameter may be reduced from 5 to 4½ or 4 inches, if desired. Lacking solid wood, the cylinder blocks may be glued up from boards of any convenient thickness. The solid blocks will produce the nicest grain effects.

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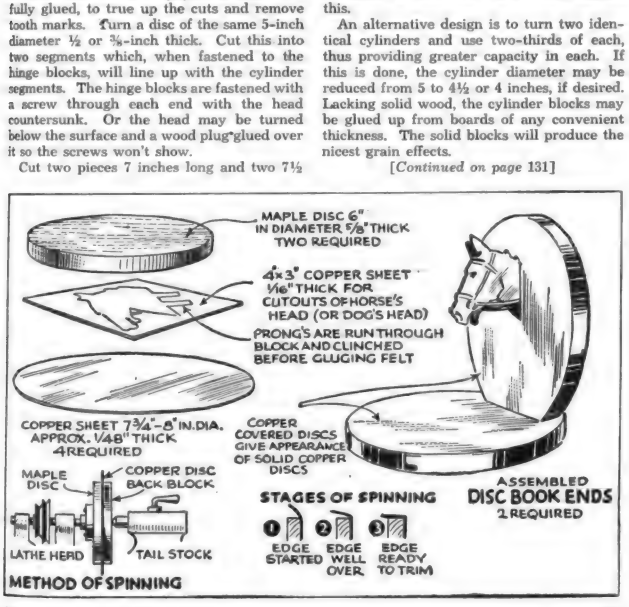
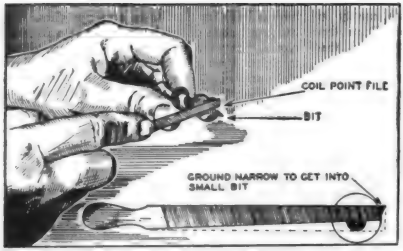




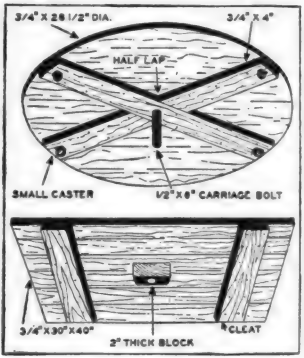
SHOP SHORT-CUTS

Point File Keeps Bits Sharp

IF YOUR augur bits need touching up and you have no regular augur bit file at hand an excellent substitute can be had by purchasing an auto coil point file, obtainable at any hardware or auto supply store. They are very cheap, costing only 5 or 6 cents each. Grind this file to a long taper, as shown, leaving the point very narrow. The resulting tool can be used to sharpen both lips and spurs of even the smaller sizes of augurs.—*W. C. W.*

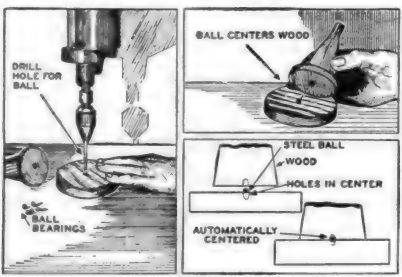
Turntable Aids Paint Spraying

A TURNTABLE is a real aid to the craftsman. Its revolving action eliminates handling of the work while spraying or painting and the work can be raised or lowered to a convenient level. Drawing at right shows a simple but effective turntable that can be made in a short time with hand tools. The circular top is best made of plywood, while scrap lumber will suffice for the base.—*R. F. K.*



Ball Bearings Center Parts In Wood

ACCURATE and speedy centering of adjacent wood to wood, or wood to metal faces while assembling finished or semi-finished articles, can be conveniently done by making use of small ball bearings. Determine the center of each face by any standard method and drill a hole to a depth approximately equal to the radius of the ball, the drill having a diameter equal to that of the ball. Gently tap the ball into one of the holes and place this part over the other one.—*W. W.*



Face Plate Vise

A SMALL vise mounted on the face plate of a metal turning lathe supplies a very convenient means of clamping irregular and flat shaped pieces for facing and boring. The best vise for this purpose is one that is now being sold in the ten-cent stores for 25c. To insure that the face of the fixed jaw is exactly at right angles to the face plate, bolt a piece of square stock on the face plate, clamp the vise jaws on this piece which will allow you to face the base of the vise on the lathe with the

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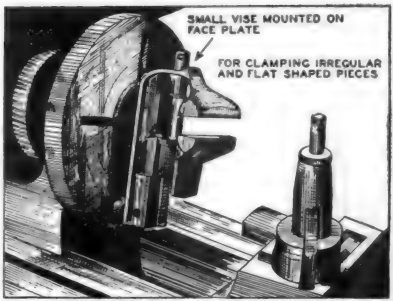
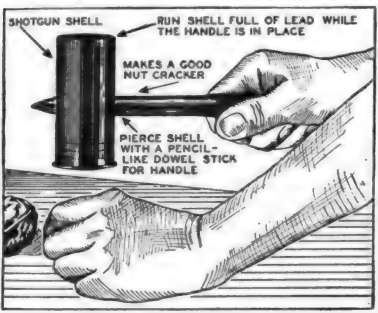




A Shotgun Shell Hammer

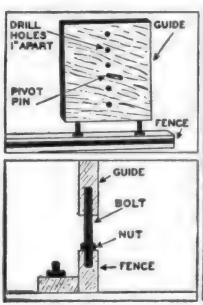
A USEFUL and handy soft hammer may be readily improvised by using a 10-gauge shotgun shell for a mould. Pierce the side of the shell with a pencil-like dowel stick for a handle and run the shell full of molten lead while the handle is in place.

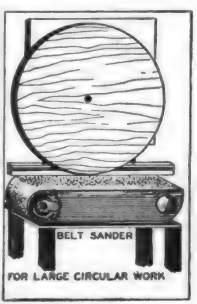
Do not remove the shell but allow it to wear off. This hammer makes a good nut cracker and does not scar the furniture. Incidentally, be sure the percussion cap of the shell has been exploded before you attempt pouring in the lead.—*J. G. V. H.*

Easy Way to Edge-sand Circular Work

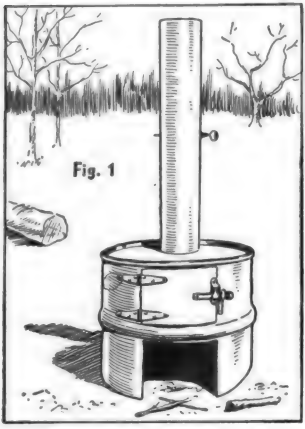
PIVOT sanding of circular work on the belt sander can be done with the use of the simple jig shown at right. This consists of a piece of ¾-in. stock measuring about 8x12-in.

In use, an approximate pivot pin location is selected and the pivot pin, (a ¼-in. dowel) is inserted in the hole. The work is fitted on the pin, then the adjusting nuts are turned so that the work comes into contact with the belt and is slowly rotated to sand the whole edge.—*R. F. K.*





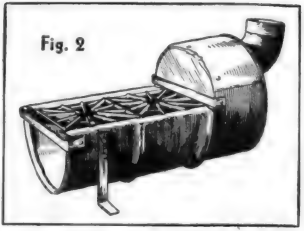
Oil Drum STOVES



YOU can make an excellent stove for the camp, cook shack or backyard from an old oil drum! Above are two good examples. Figure 1 shows half a drum set on the ground with points sticking up around a hole at the back side to make a tight fit for the stove pipe.

Two openings are cut in the front. One piece is hinged back in place and becomes the fuel door. It has a lock made from strap iron. The section cut from the lower opening is thrown away, this hole forming the ash pit. For the grate, several iron rods are pushed through holes made for them half way up between top and bottom. They are spaced 4 inches apart.

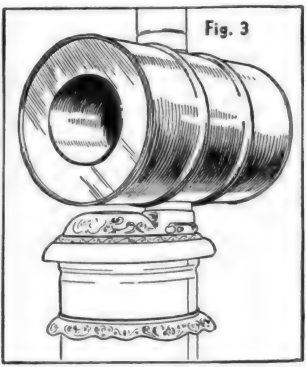
A whole drum is used in Figure 2. With two L-shaped strap irons bolted to one end, it stands rigid. A short elbow flue is fitted into a hole in one end, the upper half cut away and the sides bent over to take the top of an old-fashioned gas stove as indicated. Part of the cutout end is used to close the opening at the right of the grate—small stove bolts holding it firmly in place. This stove



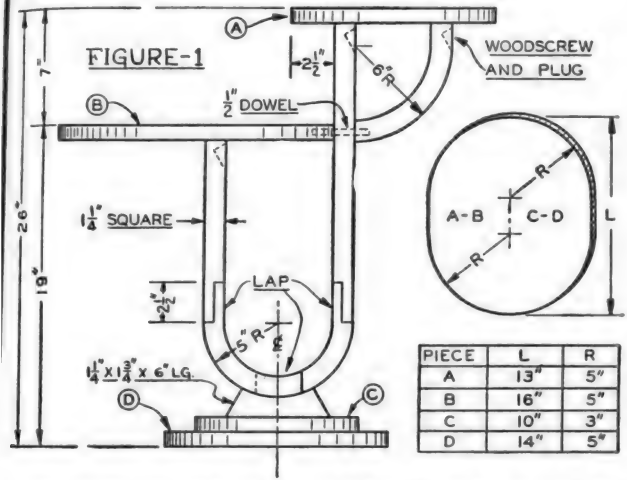
is so light that it can be tossed into the back end of the car easily.

Figure 3 shows a good example of the use of old oil drums to increase the efficiency of coal burning stoves of the type still widely employed in country stores. The owner of the business estimates that at least 25% additional heat is obtained, particularly when a small fan is mounted at one end to force a stream of air through the center.

One such installation has this tube running through level; another provides a tube (10 inches in diameter) with one end three inches higher than the other. The tubes were made much like a stove pipe but in three sections, a center section and the two end pieces with collars, so that the whole assembly could be made without opening the barrels. A few spot welds hold the tube in place.—*D. R. Van Horn.*



Modernistic End Table



PIECE	L	R
A	13"	5"
B	16"	5"
C	10"	3"
D	14"	5"

(Picture of finished table on page 80)

FOR the craftsman who likes to make useful things for the home, this modern end table is of striking design and yet simple in construction, and requires only two evenings to construct.

It is suggested that maple, birch or walnut be used for the tops and base pieces and that poplar or white pine be used for the curved stem pieces. To begin the construction, lay out the four pieces A-B-C-D as shown in Fig. 1 and saw these out on the band or jig saw. Sand the top faces and the edges of these pieces. Now on a piece of the poplar or pine 7"x7"x1¼" lay out a 5" radius in one corner. On the same center draw a 3¾" radius. Now mark off the quadrant area using the center of the arcs. Continue the arcs to the edge of the wood at the cross grain end and at the other end (with the grain) draw the lines tangent to the curves to the edge of the wood. Now saw out this 1¼" section on the band saw. A heavy jig saw will do if a band saw is not available.

Now using this piece as a template, cut out another identical piece. In the curved sections of these pieces mark off half the thickness of the stock for a half-lap in a vertical plane. Saw out these sections with a back saw, then match the laps using a wood rasp. The purpose of all this is to arrive at a 180 degree curved piece which is 1¼" square. Now saw out the tangent ends also for a half-lap joint but at 90 degrees to the half-lap on the curve. A glance at the drawing will render this explantion clear.

Cut out two pieces of 1¼" square stock, one about 11" long and the other about 18" long and cut these for half-lap joints to match the laps cut in the tangent laps. With these pieces cut, glue up these joints using clamps, taking care to get the long pieces parallel. When the glue job is set sand these three joints until they are smooth. On a piece of similar stock 1¼"x1¾"x6" long, lay out a 5" radius arc from the centerline then mark off the ends at 30 degrees, then saw this piece out on the band saw. Screw this piece to the

[*Continued on page* 130]

MAKE YOUR OWN SAILBOAT

by George E. Basich

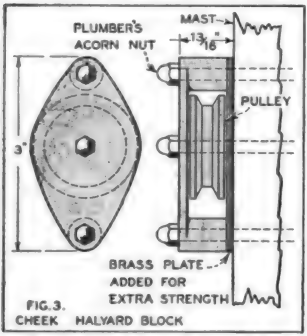


FIG. 3.
CHEEK HALYARD BLOCK

Above: Side and end view of cheek halyard block. Two sets needed for jib and mainsail. They are placed at foot of mast, one on each side, using common bolts. Below: Shroud tang. Three are needed placed well up on the mast. Also useful if a diamond stay is needed. Lip is filed to fit prongs of cable socket at bottom of page.

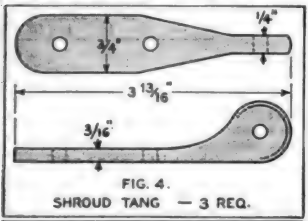


FIG. 4.
SHROUD TANG — 3 REQ.

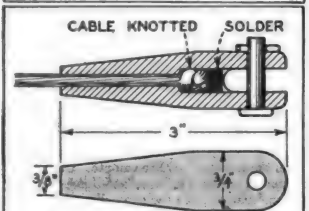


FIG. 5.- CABLE SOCKET — 6 REQ.

GENERALLY, the first department in which the average sailboat builder thinks he can economize, is in the brass fittings. He comes to this conclusion after a hasty perusal of a boat supply house manual informs him that he will need at least twenty-five dollars for ordinary fittings. By the time his boat is ready for fittings, his construction budget has shrunk considerably.

It is therefore no occasion for wonderment that so many well-built boats are floated with clumsy, ugly, dull accessories instead of the more conventional marine fixtures.

We, too, faced this same problem but our boat was far too beautiful to be trimmed with any but the brightest brass. We decided to make our own.

Our patterns were cut from red gum scrap which we had left from the centerboard trunk. We cut them out carefully, sanded them down well, and gave them two coats of shellac to ease the task of the foundry man. For four dollars we had over eight pounds of brass cast at a local pump manufacturing company.

We cut ¼-in. brass rods for bolts and threaded them so that plumber's acorn nuts would fit. These were obtained at the hardware store for a few cents and enhanced the appearance of our work.

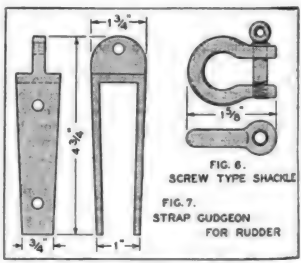


FIG. 6.
SCREW TYPE SHACKLE

FIG. 7.
STRAP GUDGEON
FOR RUDDER

Cable socket, left, showing how cable is sweated in with molten solder. Six of these are needed, one at the end of each stay. Above, Fig. 6., screw type shackle. Very convenient fitting used at head of mainsail, and at head and tack of jib. Three are necessary but extra ones may come in handy. Fig. 7 shows strap gudgeon for rudder. This arrangement provides for a long bolt for the rudder to turn on. When properly installed, rudder cannot float away as sometimes happens when pintles are used.

FITTINGS

In figure 3, you will see that you need two pulley sheaves. The patterns are made without a rope groove, which is later turned into the brass casting. Three bolts, passing through the mast, hold both cheek blocks in place.

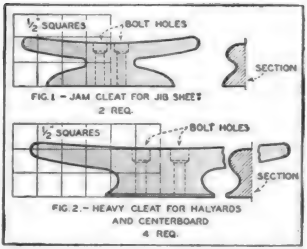
When making the cable socket pattern, do not cut the slot for the shroud tang. This will have to be cut into the brass by hand later. The backstay wire fits into one end at A in figure 5 and is knotted in the larger hole at B. The hole is then sweated full of solder. This makes an exceptionally strong cable end.

The shackle is to be cast without the pin, of course. The pin is a threaded piece of rod flattened on one end so that no tools are necessary when the sails are taken off the tracks.

Remember to have an extra pair of strap gudgeons made. Some one at the dock is bound to drop his rudder overboard this season and if it isn't you, you may be able to sell a pair at a profit. Most inland hardware dealers allow their marine stock to deplete sadly after the first spring rush and you may have a little difficulty in getting another pair immediately.

The sliding gooseneck is a very practical affair and keeps our sail hanging beautifully. It is not as complicated as it looks, incidentally. It consists of two angles which support a 5/16-in. brass rod, two plates which are fastened to the boom, and a sliding block which allows the boom to pivot freely in two directions. The grommet in the tack of the mainsail is held in the groove of this block by a pin.

Most difficult of all fittings was the combination bow plate and forestay anchorage but the results were well worth the efforts. The mooring rope passes through the one inch hole at B and is fastened to a cleat halfway back to the mast on the deck. The cable socket of the forestay fits over prong C in figure 10. Two screws from the top into the deck and two from the front into the steam, hold it in place.



Figs. 1 and 2 above show jam cleat for jib sheet (two needed) and heavy cleats for halyards and centerboard sheet. Also for mooring cleat. Four required. Below, Fig. 8: With this sliding gooseneck your mainsail will always hang perfectly. It is made up of several small parts and assembled as shown. The angle piece (A) may have to be bent slightly to meet contour of mast. This angle, placed on forward side of the mast will also make an excellent spinnaker eyeplate. Fig. 9 shows top view of gooseneck. Below, left, is combination bow and fore stay plate.

The screw at A also catches the cutwater which covers the front of the stem.

After finishing, you can have all of the fittings chrome-plated, if you prefer.

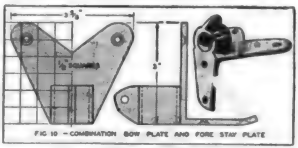
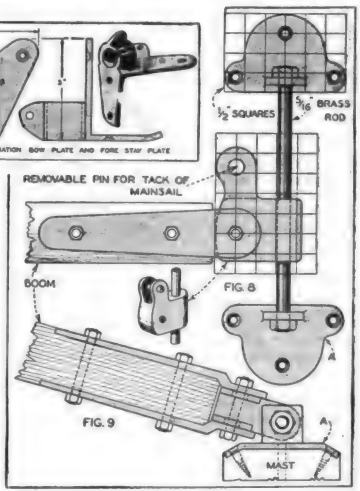
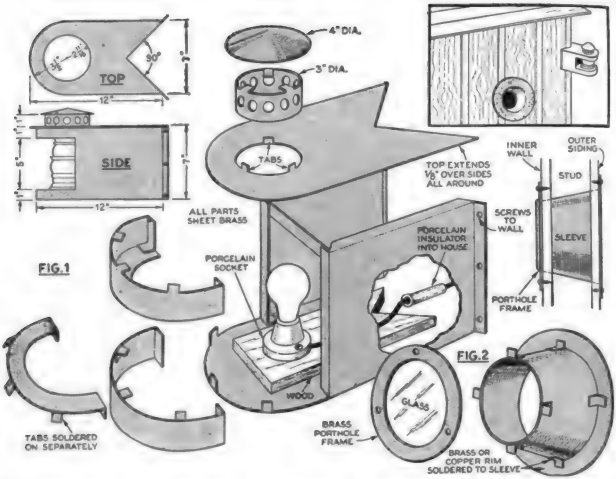


FIG. 10 – COMBINATION BOW PLATE AND FORE STAY PLATE





Marine Lamp for Beach Cottage

(Photo of finished lamp on page 80)

THIS novel lantern for the beach cottage is very simply made of sheet brass, copper or even of galvanized iron and painted to match the trim of the house. It is entirely a tin-snip and soldering job, well within the range of the amateur. If electricity is not available it can easily be rigged for a kerosene lamp.

Construction details are illustrated in Fig. 1, above. The main body is cut from a single sheet and soldered and bent as shown, with a porcelain socket mounted on a wood block screwed or nailed to the bottom. The curved members are soldered to the body by means of tabs, which can be separate strips soldered on.

A marine-type globe to slip over the light bulb can be obtained from a yacht outfitting store or supply house. It is advisable, of course, to buy the globe first and to cut the metal parts to fit accurately. The advantage of having the light located on a corner of the house is that it illuminates both sides.

To carry out the marine idea in a beach cottage even further, a row of neat portholes, made as shown in Fig. 2, is very effective. This design is for a house with double walls; that is, with inside sealed with knotty pine or wallboard. The tapered sleeve permits full light in a thick wall of this nature, and at the same time tends to prevent water from rolling in. For single cottage walls, such as board-and-batten construction, no tapered sleeve is required, but the glass disc should be fitted with a cork or rubber gasket to keep out rain.—*Hi Sibley.*

Featured Next Month

The March issue of MECHANIX ILLUSTRATED will contain a real treat for model fans—a gas powered midget racing car. This car, the *M I Whirlwind*, differs radically from the conventional miniature racer in that it is driven from the rear by an airplane propeller instead of the usual wheel-gear drive. The result is more perfect streamlining, less road resistance and truly flashing speed. You'll want to build this racer, so be sure to watch for your March number.

Two-Toned BRACELET is profit project

HANDYMEN and craftsmen without power tools who want to make sparetime profits will find this two-toned wood bracelet an excellent project. One chap with extra time on his hands made and sold more than 100 of them at practically no cost and at a price of from $.75 to $1.50 each, depending upon the kind of materials used. Colored plastics brought the higher prices, for the material cost a little and was slightly harder to finish. Those of the walnut-maple composition like the one shown in the accompanying drawing gave nearly all profit. Besides the small amount of wood needed, two short lengths of rubber elastic and filler and lacquer were the only other materials needed.

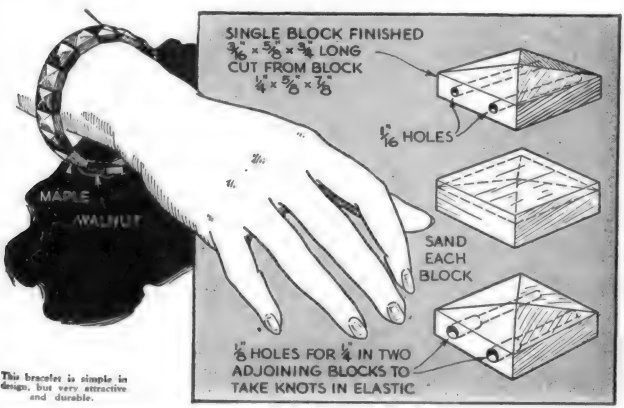
Here's how. Cut a number of blocks of both maple and walnut ¼-inch thick, ⅝ or ¾-inch wide and ¾-inch long. Smooth the edges and bottom of each block on a sheet of No. 000 sandpaper. Bracelets vary a little in size, but one 2½ inches inside diameter will fit small and medium wrists. You will therefore need 10 or 12 of the pieces, 5 or 6 of each. The next step is to sand the raised design on the top of each piece. Make each edge and end the same height. With a little practice you can do this quickly and accurately.

Each block is then provided with two parallel holes 1/16-inch in diameter. Each hole should penetrate each block in the same position. While you can do this by hand with a breast or hand drill, if you have a small power drill you can make a jig to insure the same hole location in each block. If these vary the blocks will not lie all in the same line when they are strung. Enlarge the holes in one end of a walnut and a maple block and then later string these so they adjoin to hide the knotted elastic. The enlarged holes need be no more than ⅛-inch in diameter and about ¼-inch deep.

Sand the ends of the blocks too, so when laid tight together in the form of a round or oval bracelet they will fit snugly together. The oval bracelet looks better and requires but a little extra sanding, particularly if you lay out an oval in heavy pencil on paper and stand the blocks upon this to see how they fit, when sanding them.

Fill the walnut with putty and stain and wipe off. Then after the filler has dried, whittle a plug for each block, push it into one

[*Continued on page 143*]



This bracelet is simple in design, but very attractive and durable.

the artistic craftsman will like this

ANTELOPE ORNAMENT

THE present popularity of colorful and distinctive ornaments for home decoration offers the craftsman a chance to indulge in a measure of artistic efforts which are limited only by his ability. Some of the simplest pieces of striking line or graceful form are far more successful than more ornate and elaborate designs. The piece herein illustrated belongs in the first group and any craftsman who will have the patience to execute the piece to the best of his ability will find that the richness of the design and craftsmanship will more than make him proud of the result.

The right wood is of the utmost importance, and either African mahogany or rosewood should be used. Since the quantity is small this is not an item of expense. The thickness of this wood should be 1¼" full. On a piece 6"x12" lay out the pattern as shown below. Then saw out the outside outline on jig saw. Using a handsaw, saw the piece to the depth shown in Figure 1. With this cut made, saw out the inside outline on the jigsaw. This procedure reduces the hazard of breaking off the legs. Note that the grain of the wood is vertical. Next drill the feet at the center with a ⅛" drill to a depth of ⅜".

A half-round wood rasp is now used to remove the bulk of the full rounded edges, especially at the body and neck. The rounding and shaping of the legs must be done with a sharp knife. A certain amount of patience and caution is necessary at this point; always carve *against* the grain. A coarse sandpaper is now cut into ⅛" wide strips and holding the piece in a vise using blocks of soft wood between the jaws and the work, sand the inside of the legs. Taper these to the delicately rounded ankles. Repeat this process using a medium then fine sandpaper. Then sand the body, neck and head. Just ordinary sanding is not enough on this job. It's just like stirring paint; do it until you think that it's had plenty, then do it just that much more.

Cut four pieces of ⅛" dowel ⅜" long and glue these into the holes in the feet. Then varnish the piece with the best varnish you can get.

Next turn out the two base pieces as shown in Figure 1. Drill the larger of these in three places for wood screws and countersink them from the bottom. In turning these pieces the sanding instructions still apply, only this is easy to do on the lathe. Now rub lamp black (carbon paper will do) on the bottoms of the dowel pieces projecting from the feet. Then spot these locations on the smaller base piece, taking care to get the locations in the center. Push down on the figure and you will find

[*Continued on page 134*]

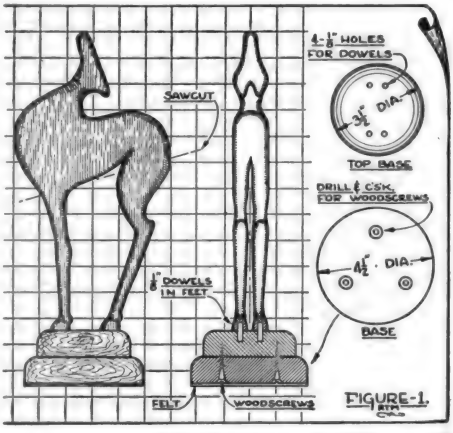


FIGURE-1.

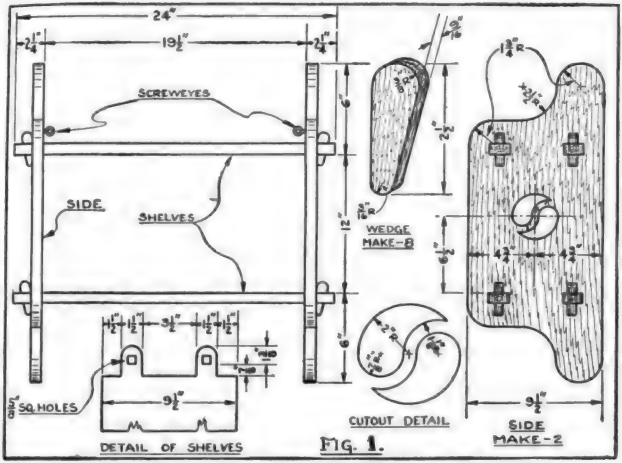


FIG. 1.

Knock-Down Portable Shelf

by Ralph T. Moore

(See page 80 for picture of finished shelves. This is an ideal one-evening project.)

HERE is an attractive shelf which is ideal for the student or traveler inasmuch as it is not only novel in appearance but it may be quickly knocked down and packed into small space and may be just as quickly re-assembled. As for the antiquity of the shelf, this is inferred by the use of the wedges to hold the shelf together, and the Chinese "Yang and Yin" symbol which is used as a decorative feature in the form of a cutout.

The construction of the shelf is very simple and should require but one full evening. First cut out two pieces 1"x10"x2'-0" long and lay these out for the shelves. Then cut these out on the jig or band saw, lay out the ⅝" square holes and drill a ½" hole in the center of the squares; then, using a square rasp, shape the hole square. When both shelves are cut check them for interchangeability; in other words they must both be the same. This done, sand smooth overall.

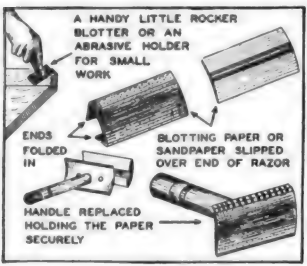
Next cut out the two end or side pieces from a piece of wood 1"x10"x44" long. You will note that while the overall dimension of each piece is 24", some 4" of stock may be saved by layout. After laying out the shelf tongue holes and the contour, saw out on the jigsaw. Lay out the "Yang and Yin" symbol and cut out on the jigsaw. Check to see if all of the tongues fit in the rectangular holes. Next cut out eight wedges and sand these smooth, fitting these into the square holes. Assemble the shelf and insert two screweyes into the sides; these may be used to support the shelf via nails or hooks in the wall. If the assembly is satisfactory, dismantle and stain as desired. When dry wax overall; do not varnish.

As to wood, maple is suggested but poplar and pine are satisfactory and the stain should be selected according to the wood used.

An excellent stain can be made by mixing linseed oil and turpentine fifty-fifty, then adding burnt umber or raw sienna, the former for a dark stain and the latter for a light. Rub on with a cloth, wiping away excess.

Beer Can Opener As Doorstop

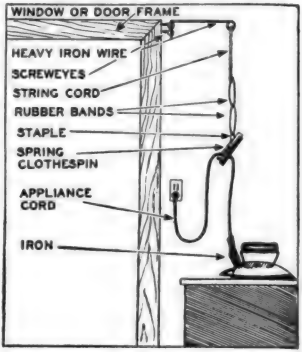
A BEER can opener of the type shown makes an effective doorstop. It is especially useful where a door such as a garage door must be kept open against a strong wind. Sharp point digs in and holds firmly.—*W. S.*



Old Razor Good Blotter Holder

DRAWING shows a handy use for one of those old safety razors that always seems to be lying around. Bottom of razor is removed and a piece of blotter wrapped around it. Handle is then screwed on and blotter is ready for use. The same stunt can be worked with sandpaper, and is particularly of value to model makers.—*A. H. W.*

HELP FOR THE



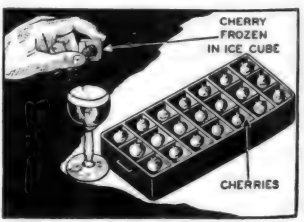
Ends Appliance Cord Deviltry

A GADGET that is useful in keeping the electric iron cord up out of the way, and prevents it from rolling and rubbing against fabrics on the ironing board, can be assembled quickly and cheaply as illustrated above.

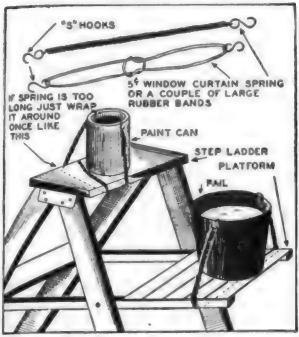
Bend wire, attach the staple (or tiny screw eye) to one handle of the clothespin, and assemble.—*R. W.*

Cherries In Ice Cubes

WHEN ice compartments in refrigerator have begun to freeze, place a cherry in the center of each. When solid serve in iced drinks.—*D. V. H.*



HOUSEHOLDER

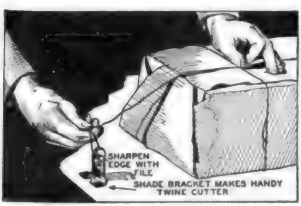


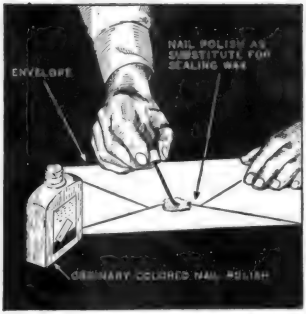
Keeps Paint Can Steady

A FIVE cent curtain spring, large rubber band cut from an inner tube, several rubberbands strung together, or any other elastic, can be equipped with an "S" hook at each end, and employed for the simple but useful purpose of holding a can of paint, pail of water, etc., securely atop a stepladder. When painting or washing a ceiling ladder may be moved about safely.—*A. V.*

Shade Bracket Cuts Twine

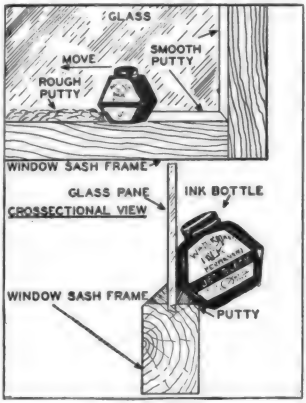
A SHADE bracket, of the type shown, will be found useful for cutting twine and heavy cord when wrapping packages. Cutting slot of the bracket can be given a knife-like edge with a few strokes of a file.—*W. S.*





Nail Polish For Sealing Wax

LETTERS can be sealed effectively with ordinary colored nail polish. This method is much simpler than using sealing wax.—*W. S.*



Ink Bottle To Putty Window

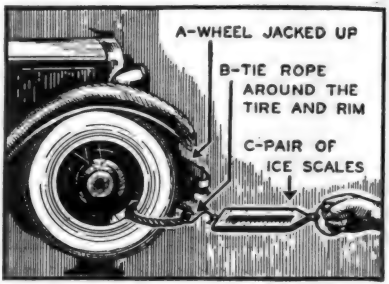
A POPULAR make of ink bottle of the beveled shape shown will be found handy for applying putty to a window.—*A. V.*

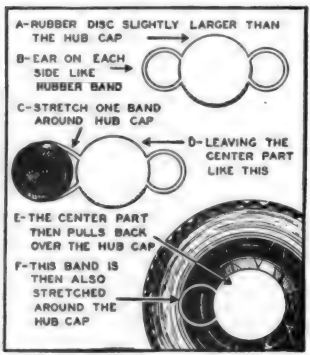
Hints For The Motorist

by A. H. Waychoff

Getting Equal Brake Adjustments

FOUR wheel brake adjustments can be equalized by means of a heavy spring scale such as is used for weighing ice. Tie a rope or chain around the wheel spokes at the rim, hook the scale on, and with the brake set pull until the wheel turns slightly. The wheel, of course, must be jacked up. When all four wheels show the same poundage on the scale they are all set to the same adjustment.





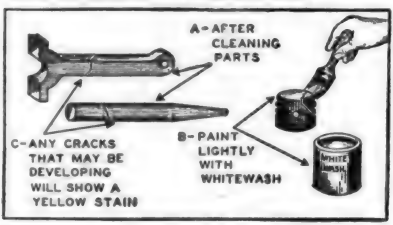
A Simple Hub Cap Protector

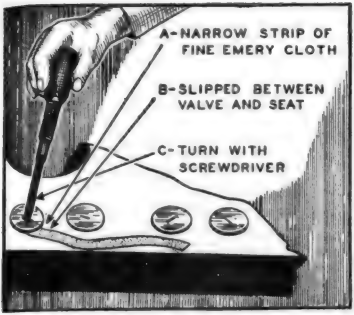
TO PROTECT the chromium finish of hub caps when driving over unsurfaced roads or other places where the caps are apt to be damaged, a set of these covers will be found very useful. To make them cut up an old inner tube, shaping the four covers as shown in drawing at left. The center part should be slightly larger than the diameter of the hub cap. To put on slip one loop around the cap, pull the protecting cover across then snap on the other loop.

Whitewash Shows Up Defects

TO DO a thorough job in overhauling the car all parts should be carefully checked before reassembling. Do this by giving each part, after cleaning and drying, a light coat of common whitewash made by dissolving a little lime in water. It will dry very quickly and any defects or cracks, even if invisible to the naked eye will show up as a yellow-green stain. This is caused by oil or grease in the defect, out of reach of cleaning solvent, being drawn up into the whitewash.

Money can often be saved by this method, because defective parts which might give way may be discovered and replaced before reassembling.



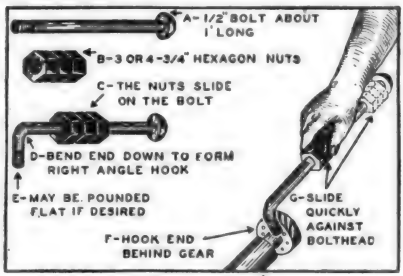


Emery Cloth Helps Surface Rough or Pitted Valves

BADLY burned or pitted valves can be smoothed very effectively in the manner illustrated at left. A strip of fine sandpaper or emery cloth not over a half-inch wide is laid on the valve seat, prying up the valve a little with a screwdriver. Turn the valve in the usual manner with screwdriver or valve grinding tool. The rough valve is nearly seated and is then easily finished up with valve grinding compound. Of course, if the valves are too far gone nothing can resurface them, and the only solution is replacement.

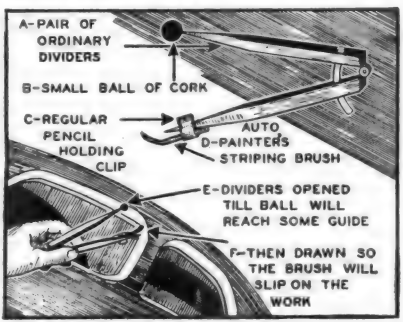
An Improvised "Hammer Blow" Puller

A HAMMER puller for small gears can be quickly rigged up with a half-inch bolt about a foot or so long and three or four heavy three-quarter-inch nuts. Slip the nuts on the bolt, flatten the end a little and bend down to form a hook, as shown. To use place the hook behind the gear to be pulled and slide the bunch of nuts quickly against the bolt head. Gear will quickly loosen.

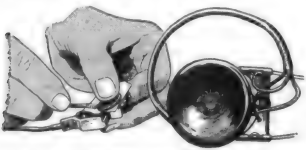


Dividers Make Excellent Striping Tool

AN ORDINARY ten-cent store pair of dividers or compass can be quickly converted into a tool that will enable the amateur to do professional-appearing striping. Clamp the striping brush in the pencil holder and put a little ball whittled from a small cork on the other point. Open the instrument so the cork ball can rest on an edge or moulding parallel to where the stripe must go. With the ball end acting as a guide it will draw a uniform line.



Improvised Battery For Testing Earphones



A "FLEA POWER" battery for testing radio earphones can be improvised in a few seconds by using a five-cent piece and a one-cent piece. To use the device, moisten a piece of ordinary paper with the tongue and place it between the coins. Touch one phone tip to the nickel and tap the penny with the other. If the phones are functioning, a series of clicks will be heard in it. Current is generated in this miniature "battery" because of electrolysis between the dissimilar coins in the presence of the weak acid in the saliva.

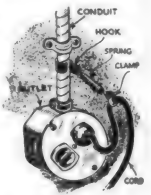
Novel Telephone Lamp

A table lamp of unique appearance can be made out of an old telephone of the upright type. The transmitter head is removed and replaced by a regular lamp socket, which is easily fastened in place by means of a short nipple and a couple of nuts. If the switch mechanism is still in order, it is wired in series with the lamp, so that the latter lights up when the earphone is picked off the hook.

The old phone switch contains several arms and contacts; examine it carefully and select one pair that closes when the hook is up and opens when it is down. The cord to the earphone is then merely a dummy, and doesn't connect to anything.

Another idea is to mount a small toggle switch in the top of the receiver, wiring this to the socket by a short length of flexible wire. Thus, the receiver can be left permanently on the hook and the lamp controlled by a flip of the switch. The shade is supported by a snap-on type clip fitting over the bulb.

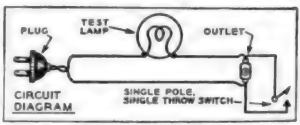
Spring Holds Electric Wire



A GARAGE mechanic who is constantly using trouble lights, electric drills and other portable tools was troubled by having the plugs work out of the receptacle, usually when he was on his back or in some other awkward position. He finally overcame the nuisance by fitting the end of each flexible cord with the simple spring and clamp arrangement shown in the drawing. This takes the strain off the plug, incidentally eliminating another trouble: loosened connections to the contacts. The hook is made with a wide mouth so that it can be slipped on and off easily.

The same idea in slightly modified form can be applied to home appliances if the outlet plate is fitted with a cup hook or similar projection to which the spring can be attached.

Trouble Shooter's Cord



The simple circuit shown above will be found very useful for testing common electrical appliances. The parts are most conveniently mounted on a small board. The switch can be an ordinary snap or toggle type. A 25- or 40-watt lamp is used.

The device to be tested is plugged into the outlet, and the lamp then lights up in accordance with its condition. If it is "open," the lamp will not light at all; to verify this, close the switch. This shorts out the appliance under test and makes the lamp go on.

For "continuity testing," plug in pair of wires in the outlet and use these as probes; for instance, on the commutator of a generator or motor to find open windings.

BRINGING IN THE LEAD-IN

THE weakest part of most radio aerial installations is at the window where the outside wire must be brought into the house. The usual arrangement makes use of an insulated, flexible copper or brass "lead-in strip," which is satisfactory only if the window is not opened and closed very often. Invariably these strips break.

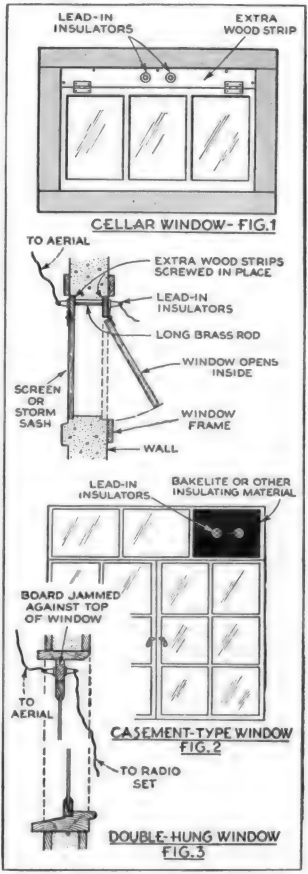
The radio fan who goes to the trouble of putting up a good aerial should also put in a lead-in better than a mere strip. The drawings on the right contain some suggestions of value.

If the radio "shack" is in the basement, a cellar window can easily be revamped, as shown in Fig. 1. The idea is to saw off part of the window (and also part of the outside screen or storm sash, if any is used), and to screw an extra strip of wood at the top of the frame. This strip should be about 1½ or 2 inches wide, which means that not more than one inch needs to be ripped off the top and bottom edges of the window. The hinges must be reset, but this takes only a few minutes. The extra wood strip now permits the use of permanent lead-in insulators. If an outside strip is also installed (to accommodate the screen or storm sash), separate the sections of each insulator and joint them by means of a piece of threaded brass rod of the right length. As many as six or eight insulators can be mounted on this extra strip, which is more than most radio experimenters ever require.

Casement-type windows require different treatment, as shown in Fig. 2. The simplest thing to do is to remove one small pane of glass altogether and to replace it by a piece of Bakelite or waterproof plywood, in which holes for lead-in insulators can be drilled. It is quite possible to drill holes in glass by means of a drill press, but this is a slow, tedious and somewhat tricky job.

With standard double-hung windows, the best arrangement is a board placed against the top of the outside window, as in Fig. 3. It should be nailed in place with thin brads, so that it won't fall when the window is opened. If the inside wires interfere with curtains or blinds, put the board on the bottom, under the inside window.

When assembling the feed-through insulators, be sure to use cork or lead washers under the nuts. Without them, the porcelain is likely to crack.



Adjustable Enlarger Table

Necessary details for building this table are obvious in the drawing at left. Dimensions are given in the text.

by M. R. Mohringer

MY ENLARGER is of the autofocus type and will take up to and including 4x5 negatives. The maximum enlargement possible was 3½ diameters, and as there were times when I wanted to enlarge a small section of a negative to 11x14, I raised the lens board from the regular adjustment used with the autofocusing mechanism simply by drilling and tapping new holes about ¾-in. higher for the screws which hold the lens board. Then, by constructing the adjustable table illustrated in the accompanying photos, I have been able to increase the enlargement to 6 diameters.

The important feature of this table is the readily adjustable support for the easel, which is held at any desired height by a thumb screw. One-inch pipe was used throughout, with the exception of the standard which supports the easel board, this being 1¼-in. pipe.

By drilling and tapping this pipe about 1-in. from the top for a thumb screw the 1-in. pipe, which is fastened to the underneath side of the easel board by means of a pipe flange, can be held in any position when inserted inside the 1¼-in. pipe.

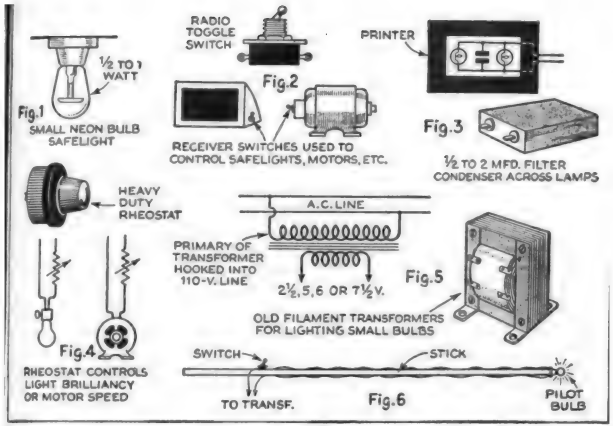
The dimensions depend upon the enlarger to be used with the table. On this one the easel board of ⅜ plywood is 24 in. square. The 2x4, which is fastened to pipe flanges with 1-in. wood screws, is 24 in. long. The two upright pipes to which the 2x4 is fastened are 20 in. apart, center to center. The height of the table is 30 in. over all. The 1¼-in. and the 1-in. pipe, forming the support for the easel board, should be the same length, and should be such that the 1-in. pipe extends into the 1¼-in. pipe about 2½ or 3 in. when the easel board is extended flush with the top of the enlarger support.

Anyone wishing to construct this table will probably find it desirable to have a plumber cut and thread the various lengths of pipe. The cost for the pipe, including cutting, threading, and assembling for the table shown was $4.00. A machinist drilled and tapped the hole for the thumb screw for 15c. All fittings should be screwed as tightly as possible, thereby making the table extremely rigid.

A coat of aluminum paint gives a very suitable finish to the job.

Photography With a Wide Open Lens

If you want to take brilliant pictures with the subject in sharp focus and the background blurred out, try shooting with the lens wide open. Photography under this condition, with suitable subjects, is more capable of providing rich, brilliant pictures than a lens with its diaphragm stopped down. A lens working at large apertures catches and fixes the center of interest and obscures distracting background, thus making every detail, every highlight and shadow in the face clear and lifelike.



Darkroom Uses For Radio Parts

THE writer happens to be both a radio amateur and a bit of a photographer and in his darkroom has found good use for several discarded radio parts. No attempt is made to enumerate all photographic uses for such material; just a few are shown. Anyone similarly situated can undoubtedly think of many more.

For instance, Fig. 1 illustrates an excellent use for small neon bulbs. As orange is the usual safe-light around the darkroom, except for the ultra sensitive materials, a ½ to 1 watt neon bulb will prove perfectly safe to keep lighted at all times. This is especially true of the printing room. The operating cost is practically nothing per month, so, by keeping the burning constantly, you can enter the darkroom for momentary business without having to feel for the light switch or falling over some unseen obstruction.

Fig. 2 shows the usual a.c. switch used in old receivers. Pick up half a dozen of these, any appliances come equipped with only a cord and plug. By putting a switch in the line at some convenient point the appliance can be controlled much more easily than by always being obliged to plug it in. They can be used on safe-lights, small washer motors, printers, etc.

Old filter and high-voltage condensers have their uses. Most printers operate on the principle of flashing on and off a bank of lights. In short exposures the after-glow may be troublesome. By placing a condenser across the lamp terminals (Fig. 3), this glow can be reduced or entirely eliminated. Old filter pack or even high-voltage blocking condensers can be utilized and any capacity from ½ to 2 mfd. will do the trick.

Filaments of the so-called "power tubes" were often controlled by heavy duty rheostats. In Fig. 4 is shown how such old rheostats can be used to control light brilliancy or motor speed. It is only necessary to cut the rheostat in series with one side of the line. Thus red lights can be dimmed, washers slowed down, etc. So long as the wattage of the light or instrument does not exceed the capacity of the rheostat, it is perfectly safe to use. Some of the better ones ran up to 75 watts capacity.

A 2½- or 5-volt filament transformer can find good use. Hook the primary into the 110-volt mains, as in Fig. 5, and then use the

[*Continued on page 144*]

1. EXPOSURE IN ENLARGING

Q. Is there any set rule for increasing the time exposure in the enlarger as the size of the picture is increased?—James Lowery, Kokomo, Ind.

A. Theoretically, the exposure increases in proportion to the increase in size of the enlargement. In other words, if you find it necessary to expose a negative in the enlarger for 8 seconds, when making a 5x7 enlargement, the exposure should be increased 4 times, or to 32 seconds when making an enlargement twice the size. This is correct in theory but does not always work out in practice. The best way to determine the actual exposures necessary is to make test strips of the negative.

2. HEAT CURLS NEGATIVES

Q. What causes my negatives to buckle and curl in the enlarger and how can this condition be avoided?—L. M., Hadden Heights, N. J.

A. Negatives get hot and curl or buckle because of the heat from the enlarger bulb. This is not unusual. Most lamp housings get terrifically hot when the enlarger is used for long periods of time, and the film is then affected. Many enlargers are perforated for ventilation. Others have fins around the outside of the lamp housing to dissipate the heat, while some even have built-in fans for cooling. When working with a conventional enlarger with no provision for heat dissipation other than the fins or holes for ventilation, it is advisable to keep down the intensity of the heat by shutting off the light immediately after making the exposure. Under no circumstances should the negative be left in the enlarger while the lamp is on for any great length of time.

3. ENLARGING LENSES

Q. I wish to enlarge negatives of several different sizes in my enlarger. What changes are necessary in my lenses—or can I use the same lens for all size negatives?—Mathew Smith, Flint, Mich.

A. It is possible to use the same focal length lens in your enlarger for several sizes of negatives. However, the size of the enlargements you will obtain will be limited. That is to say, a six-inch focal length lens will be adequate for enlarging a 3¼x4¼ negative to a reasonable size, but the same lens will only permit a limited enlargement of a half-vest pocket size negative. The smaller the negative, the shorter the focal length of the lens should be. If you are content to accept the limitations of the lens, you can use it on both small and large negatives. Keep in mind, however, that the focal length of the lens also determines the largest size negative that the lens can handle.

4. STILLS FROM MOVIES

Q. I wish to make stills from my movie film. How is it done?—Rhine Condray, Monticello, Ark.

A. Making stills from movie film is somewhat more complicated than when making them from still-camera negatives. Movie film is returned to you by the processing firm as positives ready for projection. If you made a print from this, the result would be a print with its tones in reverse. To avoid this, it is necessary to make a negative from the positive film. This is done either by projecting the positive onto a larger negative or by making a contact copy of the image onto negative film just as you make contact prints. The exposed negative is then processed in the ordinary manner and prints made as usual from the developed negative.

5. COPYING PICTURES

Q. I have some old pictures I wish to copy. When doing this, how do I tell when the pictures are in focus?—Raymond Sidel, Waco, Texas.

A. Copying should always be done with a ground-glass back camera, as focusing on a ground glass is the easiest way getting the image in focus. However, if you are obliged to use a folding camera, a make-shift ground glass arrangement is possible by removing the back of the camera and substituting a piece of ground glass in the position of the film. Focus the image, remove the glass, replace the back without moving the camera and take your picture. If the back of your camera cannot be removed, it is possible to make the copy with the aid of a front lens. In this instance the lens is snapped in position in front of the camera lens. This allows the camera to be moved much closer to the subject. The actual distance must be carefully calibrated according to instructions included with each such lens attachment.

6. NEGATIVE PROCESSING

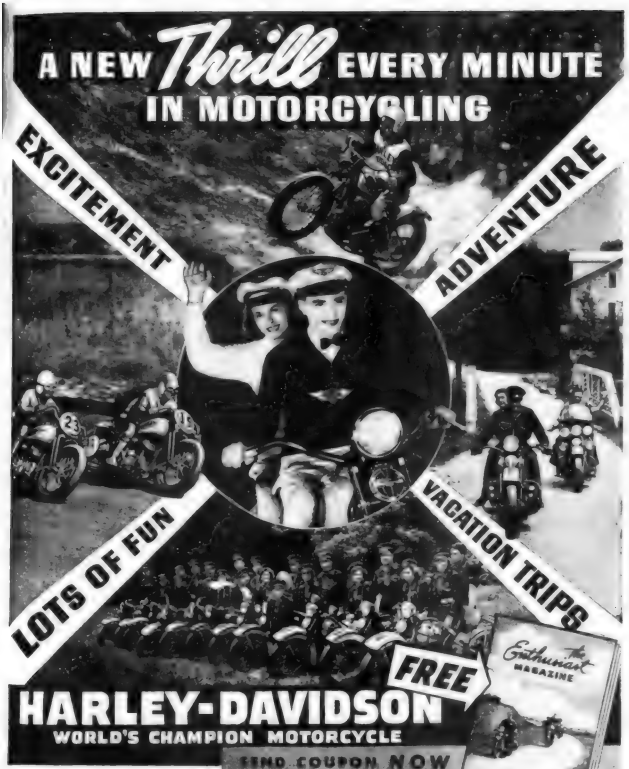
Q. My negatives seem to come out fogged and possibly over-exposed or over-developed. What should I do to prevent these conditions?—R. L. Hanson, Grand Meadow, Minn.

A. If your negatives are fogged, the condition occurs either in the camera or in the darkroom. If in the camera it may be due to light leaks in your equipment or to careless insertion and removal of the film. If it occurs in the darkroom, it may be due to light leaks in the room, to an unsafe safelight or to the presence of static electricity, although the latter possibility is rather remote. Film should be loaded tightly wound and loading and unloading should be done in subdued light—not in brilliant sun or electric light. The darkroom must be absolutely light-tight and the safelight must be *safe*. If your film is over-exposed, this condition is easily corrected by increasing the speed of the shutter or by stopping down the diaphragm an additional stop when taking the picture. If the negative is over-exposed, simply cut down the development time about 25 per cent and see if this is sufficient correction.

BIBLIOGRAPHY

Questions asked on this page have frequently been discussed at greater length in articles that have appeared in this magazine or in other publications published by Fawcett Publications. Henceforth, questions will be numbered. Corresponding numbers will be given below together with references to the articles, publications and page numbers in which the particular subject has been discussed, if at all. This will enable readers to compile an extensive and valuable reference library on photographic technique not otherwise possible. The reference publications are all available from Fawcett Publications, Inc., Greenwich, Conn., for 50 cents each, postpaid.

1. **Exposure in Enlarging. See "Enlarging is Easy," page 104, Good Photography No. 2.**
2. **Heat Curls Negatives. See "Enlarging Without Heat," page 101, Good Photography No. 2.**
3. **No reference.**
4. **No reference.**
5. **Copying Pictures. See "How to Make Copies," page 124, Photography Handbook No. 4.**
6. **Negative Processing. See "Keeping Cool at 90," page 58, Photography Handbook No. 3. Also see "Technique of Speed Processing," page 74, Photography Handbook No. 4. Also see "Tank Developing Simplified," page 57, Good Photography No. 1.**



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How To Bowl

[Continued from page 41]

other pins for a strike. Thus, ten perfect hits with a very fast ball will not result in as many strikes as ten identical hits with a somewhat slower ball.

All bowlers should strive to perfect a uniform delivery, throwing the ball with the same speed for every shot. You can accomplish this with least trouble if you throw a straight ball. A person throwing a hook ball will find his ball curving less sharply on a slippery or "fast" alley. His temptation will be to slow down his delivery, throw a slower ball and give the slower moving sphere an opportunity to create the necessary friction between alley surface and ball to produce his familiar hook. This change of pace should be avoided, unless proper results can not be obtained in any other way. First the bowler should select a spot a bit closer to the center of the alley than is his custom to bowl over, and see if he can get the usual results from this new spot. In the case of a slow alley, one which has a rougher surface than average, the hook will be wider than the bowler expects because of increased friction between the alley and the spinning ball. In that case a spot somewhat to the right of the ball's usual path should be selected. By selecting a spot slightly to the right or left of the usual path, for a fast or slow alley, you do not have to change your point of delivery at the foul line. While some teachers recommend moving the delivery point closer to the center of the alley on a slow surface, and closer to the right-hand gutter on fast surface, I can not subscribe. To do this you must disrupt all the habits you have developed in laying the ball down at the precise same spot on the foul line. To my way of thinking, it is much better to select a new spot to bowl over, but retain your usual delivery spot.

The average bowler builds up his score more on spares, cleaning the alley of all the remaining pins on his second shot, than he does on strikes. Of course you must concentrate on strikes, and you will not be a high score bowler until you can get six or seven strikes in every game; but neither will you be a high or even average bowler, unless you can pick up spares regularly.

Simply stated, my rule for throwing for spares is this: Every spare leave you may have, with one exception, should be made from your original position with the ball placed on the same spot at the foul line as you place it for a strike. The exception is when you have one, two or three pins standing in the right-hand corner of the alley, that is, the six, nine, or ten pin, one of them, two of them or all three.

In this case you move to the extreme left side of the alley, delivering the ball six or eight inches in from the left side of the alley.

In every instance, select a spot when bowling for spares as you do when bowling for strikes, and bowl for that spot, not the pins. Remember, throw the same ball, straight or hook, for your spares that you throw for a strike.

When you have selected a ball that fits, have mastered your footwork and armswing, and have learned to throw a uniform, accurate ball, you will have everything necessary for a finished bowler except a bowling disposition. To be a really good bowler, you must have this, a combination of coolness, courage, ability to concentrate and smile under adverse circumstances.

When the game gets tight, take your time, keep relaxed and concentrate on doing your best. Be sure you are set before delivery, have clearly in mind what you intend to do and accept the results cheerfully. Nothing upsets your opponent more than to see that nothing upsets you.

The bowling alley shown is one of the newer alleys, a result of the tremendous increase in the popularity of the sport with both men and women.

Ahoy, Boat Lovers!

The 1940 Edition of HOW TO BUILD 20 BOATS is Out!

Fifth in the famous Fawcett series of boat books, this handsome 50-cent volume is the best, most complete, and most useful of its kind ever published.

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Your Job—Radio Servicing

[Continued from page 47]

Broadcast and public-address amplifier operating is a natural step forward for trained radio technicians. Here is a typical amplifier control panel: the one used at the New York World's Fair.

correspondence schools. Both offer their own advantages. Send for descriptive catalogues of their courses and decide for yourself how well they fit your needs. In the final analysis, no school is going to make you a better service man than you are temperamentally equipped to be.

Residence schools are those in which you report for instruction every day at a building equipped with every variety of radio and electrical apparatus. You take down sets, reassemble them, under guidance of an instructor, asking questions as you go, listening to his explanations. Residence training usually is completed in from three to six months.

Correspondence courses offer expertly prepared lessons which come by mail. Light experimental apparatus may be included. Your lessons are graded by expert instructors, mistakes pointed out, doubtful points cleared up. If you have the ability to learn from books, correspondence courses give you a thorough background and you can complete the course at your own pace, the average time being around a year.

Whatever type of training suits you, it will be expected that you have a grade school education, and high school training is practically a requisite if you expect to advance into the better paying jobs in the field.

And now that vital pocketbook question—"How much can I make?"

The income chart on page 119 will give you average wages in various classifications. Medium income for experienced men employed by others is $30 to $35 a week, with $40 to $50 representing high wages, and $18 a week a fair average for beginners—and you're likely to be classed as a beginner for at least two years if you "learn as you go." Many radio service men are self-trained—one-fourth of them, according to one estimate.

If you gross $70 a week in your own servicing business, your net income will be about $35. Who gets the other $35? Old Man Overhead. You can't keep him off your payroll. Sales of parts, accessories, sets or other side-lines will naturally boost your income. You will charge your customers about $1.50 an hour for service and your average call will be $3.

We have already mentioned initiative as a quality of the independent service man. Here's what you can do when you're on your own. Go after antenna business during the moving season, contacting newcomers to your community. Sell yourself to radio stores and jobbers as a reliable man who can be depended to take over service calls which are usually headaches to them. Put in stock for an electrical goods store. Go after business on the new portable sets in rural areas which don't have power lines.

It is fine to start out with enough capital to last a year, but not a great deal of cash is needed to get started. You can gradually expand. Go after public address installations, renting the equipment as well as installing it. Look into the income possibilities of a sound truck—one of those traveling loudspeakers which shout the reasons why you should buy your red flannels at Dinglekofer's

or elect Oscar Doakes justice of the peace. If you're smart enough to learn radio thoroughly—and basically all that is required is good intelligence, not genius, plus willingness to work like a dog—you have so many ways of turning an honest dollar that only a few of the possibilities can be suggested in this article. Here are some of the more important answers to the question, "Where do I go from here?"

AVIATION. It's no secret that right now the aviation industry is booming—but not for unskilled laborers. The skilled radio service man will find aviation doors thrown open to him, for radio is as indispensable to the modern airplane as a propeller.

CIVIL SERVICE. Uncle Sam, state, and city governments need radio service men for the great variety of radio apparatus used in running the country. The universal use of radio police cars is merely one instance of how indispensable radio has become to government. Examinations to fill radio positions are held periodically; make inquiries at your city hall. One advantage of civil service is that salary and job tenure is secure.

MOTION PICTURES. Every modern movie is built around sound. If you aspire to be another Clark Gable you probably won't get a Hollywood job; if you are an expert on sound equipment, your chances are excellent. But much closer home you will have a chance to keep the sound projection equipment of your local theater in working order.

SALESMAN. The best and highest paid radio salesmen are those who have had service training. Customers can't stump them with embarrassing questions. Employers prefer them.

EXECUTIVE. Scratch an executive in the radio and electrical field and you'll probably find a man

[*Continued on page 120*]

Income Chart for RADIO SERVICE MAN

These figures represent *average* incomes for various classifications of radio work, and these may vary considerably according to local conditions. Lower wages are more likely to be encountered than the higher ones listed; this chart gives the national range of income.

Beginners (first couple of years)	per week	$18
The national minimum figure of the wage and hours act (30 cents an hour) represents the lowest level of income to be expected.		
Experienced service men, medium wage range	per week	$30 to $35
Service men with much experience, specialists, in urban communities, high wage range	per week	$40 to $50
Jobbers' field service men	per week	$30 to $60
Civil Service—U. S. Government positions	per year	$1800 to $2800
Aircraft radio service men	per month	$125 to $175
Average charge made for labor if you are in business for yourself	per hour	$1.50

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Your Job—Radio Servicing

[*Continued from page 119*]

who has done his stint as operator or service man. It is only natural that the men who direct the industry should have risen from the ranks, for executives in this field need more than ordinary business training. They need technical knowledge as well. Not every good service man can become a high-paid executive, however, for the same reason that not every eligible citizen can become President. The supply is greater than the demand. The higher the job you aspire to, the more important do personality qualities become in proportion to technical knowledge.

RADIO OPERATOR. The job of operator—marine, aviation, commercial—has so many interesting possibilities that it requires fully as extended a discussion as radio servicing. In this article we can only say that operating is a logical "next step" for the service man. David Sarnoff, head of R.C.A., began his radio career as an operator.

FIELD SERVICE MAN. Jobbers and manufacturers need service men to contact their retail outlets, "trouble shooting," smoothing out technical troubles.

How are you going to get started as a radio service man? Very likely you can earn a little money while you're learning. You will have some friends and acquaintances whose sets need attention.

They in turn will know other prospects. The value of these contacts is not so much the few dollars worth of service work you may get from them immediately, as the fact that you can use them as a selling point if you find it difficult to persuade some local radio man to hire you.

Radio dealers have to employ service men—from one to six of them, according to size of the establishment. Persistency will usually get you a job as a beginner, for your wages won't be high and a willing helper on whom the "dirty work" can be foisted is a useful hand around any establishment.

Once you have a toehold in the field, your progress can take any of the turns suggested above as the most common routes of advancement. You can continue indefinitely in the lower wage brackets—plenty do; there's an eternal oversupply of workers who have learned just enough to get by—or you can dig into correspondence courses, enroll in a school, get radio books out of the library, tap sources of information everywhere available, and really go places.

Men who get to the top in radio aren't necessarily any smarter than those stuck in low-pay jobs. But they *get smarter* by keeping their learning caps always on. The fellow who keeps learning is never the one who bellyaches about being

With 37 tubes and six loud speakers, the largest of which is 18 inches in diameter, this colossus of radio is nearly five feet tall and weighs 475 pounds. It was brought out about four years ago by a Cincinnati manufacturer, and while it was never produced in any quantities, it indicates how large and complicated a radio receiver can be. In spite of its imposing appearance, there is nothing about this monster that will frighten a competent service man. Because of this complex feature of modern receivers, service men are able to obtain good fees for their work.

unable to make a living because the profession is overcrowded.

Since so many radio service men are in business for themselves, union affiliation looms less large as a problem than in many other fields. Factories and the larger sales units are most likely to be organized by the electrical workers.

One last word about the effects of technical progress on the radio service man's job. Prediction is perilous, but this much can safely be said: technological advancement won't wipe out the service man's job, but will almost certainly make it more important, increasing opportunities.

One of these days the long-heralded television set in every living room will actually start to arrive, and the radio service man will have another string to his versatile bow. Right now the experiments of Professor Edwin Howard Armstrong, inventor of the superheterodyne circuit, threaten to make present sound receiving sets obsolete. His new system of static-proof frequency-modulation radio transmission has every technician watching to see what comes of it.

Yes, it's a fascinating, dynamic, challenging and combustible field if there ever was one, this radio business. That is, if you happen to be cut out for it. You are the only person in the world who can decide that. If you haven't already taken the radio service man's vocational test on page 47, do so now. It will help you arrive at an honest answer.

Next month Mr. Cooley will discuss the profession of photography. This occupation has aroused the interest of many young men, and many young women, too, because the country is now so thoroughly camera conscious. Don't miss the March issue containing this article.

BALANCE SHEET

Advantages and disadvantages of the Radio Service Man's Occupation

ASSETS	LIABILITIES
Good chance to start business of your own	Requires high intelligence, a grade school and preferably high school education
Inventions and improvements will increase rather than eliminate service man's work	Opportunities greater in thickly settled communities; if you live in small town service work will probably have to be combined with related income sources
Semi-professional occupation which has high rating in community	Close work may be hard on weak eyes
Only small investment needed to get started in own business	Hours often long, irregular, with many night calls
Work demands skill rather than strength or endurance	Somewhat seasonal though not markedly so
Excellent training schools and correspondence courses available	Competition is fairly keen
Takes you into homes, gives excellent chances for friendly contact with people of importance in your community	Demands combination of mechanical aptitude and knack of getting along with people, for maximum success
Work is excellent springboard to higher, better-paid jobs	
Technical training gives versatile equipment for making a living	
Combines indoor with outdoor work	

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Riding The Frozen Freight

[*Continued from page 70*]

what might very easily have been grim tragedy.

Tractor freighting has become big winter business in Northern Canada. Rich gold fields of recent years have become rich gold mines far from a railway or highway. Airplanes can bring in a certain amount of equipment, and is naturally expensive transportation. In summer, boats can take in machinery a certain distance, since there are many portages. But in winter most of the heavy freight is moved when the ice is thick. Then tractor freight trains start out from railway stations. Most tractor trains consist of a tractor pulling three or four sleds, but up to a dozen sleds have been pulled by tractors.

The tractor road leads over frozen lake, over land where a portage is necessary. Virgin bush is cut down to make a path for the tractor trains. On well-used runs to big mines, telephone lines are strung along lake shores and over portages, so that tractor drivers can be in touch with their base in case of accident.

The tractors have revolutionized bush freighting. Where formerly horses were used, in recent years diesel engined tractors have pulled the freight more quickly and more economically. An idea of how much these tractors can pull in winter time through the lake-studded bushlands can be had from 30,000 tons taken into the Red Lake area of Northern Ontario alone, last winter, and the 10,000 tons taken into the God's Lake area in central Manitoba.

Young men run the tractor trains, a tough breed of lads who can take the weather, the cold and the dangers in stride. They work usually on a six-hour stretch, sleep six hours in the caboose, and go on for another six hours. They sit on well-padded seats, but even so, the bumps over rough ice hummocks, over rocks and fallen trees are felt. Sometimes seasickness is experienced by new hands. This bumping and jolting counteracts a tendency to fall asleep caused by the monotonous hum of the Diesel engines. They have to make their engine repairs in temperatures that often hover for weeks around 40 below zero. Frequently they are storm-bound when high winds and heavy snowdrifts stop traffic. When they are unable to go ahead due to engine trouble, they lay huge signs of wood on the snow for pilots who fly overhead to see. When they are making good time, airplanes flying overhead report their progress to their base.

When there is a heavy snow, sometimes a tractor fitted with a snowplough clears part of the bush trail. There was one heavy fall of snow which appeared heavy enough to stop tractor traffic. Tractors sink into soft snow, because of their heavy weight. And this was a five-foot fall of soft snow. There were hundreds of tons of supplies to deliver to the mines. The tractor operators built flanges on the caterpillar tracks of their tractors, and so the five-ton tractors with their heavy loads were able to travel over the deep snow in safety.

When a big order, anywhere up to 1,000 tons of freight, has to be delivered to one mine, then the tractors go on schedule, with little loss of time. Sometimes the roads beaten out by the tractors are then iced to make the sled runners slip along more smoothly. Downhill trips call in a special operating technique, and the whole crew works so that the weight of the loaded sled on a smooth run will not send the tractor hurtling down. Sometimes on such swings, swift-flowing rivers do not freeze over solidly enough to allow the tractor and 50 tons of load to navigate the ice in safety. Then a bridge has to be built, strong enough to hold the load.

Greatest hazard of the tractor trains is slush that forms, not on top of the snow, but below the snow. The lakes are covered with 20 to 30 inches of snow. That amount of snow is heavy. So are

[*Continued on page 124*]

Two methods of transportation meet on the frozen surface of a northern Canadian lake. In some cases the plane can get to places the tractor can't, and other times the tractor is able to get to places where an airplane can't land.

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Riding The Frozen Freight

[*Continued from page* 122]

the tractor trains. These outfits, weighing from 30 to 50 tons and jogging along at a speed of four miles an hour put additional pressure on the ice, already supporting a heavy blanket of snow. The result is that the water below, being noncompressible, is forced upwards through cracks in the ice and forms in pools on top of the ice, but under the snow. There it remains unfrozen, no matter how cold the weather. When the tractors treads dig into the snow, they bring up that slush. It freezes solid in no time. Then the men have to chop that ice away, and the tractor goes ahead a short distance, when the whole procedure has to be gone into again.

Tractor operators have devised a method for getting their tractors and loads out of slush ice and even out of the lakes when they "drown." There are few tractor trains down at the bottom of northern Canadian lakes. When an accident occurs, tractors or planes rush block and tackle to the scene. Woodsmen chop down heavy trees to make a tripod 20 feet high which is set up on the ice. If it is an easy salvage job, the hooks soon find the sleds and tractor below. The men and the tractor haul on the ropes. Up comes the load and the tractor, to freeze into a solid block of ice. But fires on the lake ice soon thaw out the frozen tractor, and away it usually goes with little reconditioning. That kind of salvage job usually takes from a day to a week.

But sometimes the load is more difficult to find. It has slipped away from the hole it went through, has sunk into mud. Grappling hooks may hunt for the load for days. Then when they fail to find it that way, a diver is sent down into the icy water to locate the load. It happened with one diver that it was so cold, he was pumped down hot air from a stove set up on the ice. The stove upset. There was a scramble to right it. No fresh air was going down to the diver. Then the men noticed the air pipes were being frantically pulled. They hauled up the diver nearly suffocating from the hot air.

Tractors are being used now in all parts of Canada where there is mining. Farthest north are the tractors on Great Bear Lake, where they are used the year round to haul timber and to haul ore from the mines to the plane and boat bases, as well as to haul supplies brought in by boat and plane.

Starfish see with their arms, but they probably can distinguish only light and shadow by the light-sensible cells that form the "eye-spots."

A dual-purpose sheep—producing good wool and mutton—has been bred for small-farm operators by federal sheep specialists.

All parts of the Jimson weed are poisonous, and especially the seed.

Flowers That Live Forever!

[*Continued from page 59*]

Some ten years ago while at work on another chemical invention, in a spirit of curiosity he immersed a rose in a solution which he happened to be heating at the moment. The flower became more or less shapeless and was thrown aside. Yet, when carelessly looked at a week later, it did have a certain attractiveness of color and form beyond that of a normally withered flower. This was the beginning of ten years of experimentation, with the result that now, the inventor, by a simple process, permanently preserves any flower, regardless of color or form, and with such perfection that at a distance of a foot or more, it cannot be distinguished from the fresh-cut flower. There are, today, over a score of brides who have been happy to possess their wedding bouquets from one to five years to date.

The process itself, given the formula, is extremely simple. It involves merely the immersion, of the flowers in a solution heated almost to the boiling point. Following that, the flowers are hung up to dry, and are then perfectly and permanently preserved. Nor are they fragile or brittle, but pliable and strong enough to be freely handled, boxed, and shipped. A remarkable feature of this invention is that the flowers may be preserved on the living, growing plant, thus producing an ever-blooming rose bush, for example. Or if it is desired, preserved flowers may be set up in growing Japanese gardens, making these appear to be in bloom.

Ever since the publication of the patent, Mr. Joffe has been receiving numerous inquiries from scientists, museums, growers, florists, and lovers of flowers, both here and abroad.

You're Right—That's Wrong

Correct Answers to Quiz on page 65

1. True	13. False
2. False	14. True
3. False	15. False
4. True	16. False
5. True	17. True
6. False	18. True
7. True	19. False
8. False	20. False
9. True	21. True
10. False	22. False
11. True	23. False
12. True	24. True
	25. False

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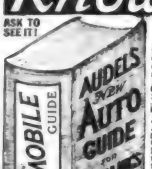

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Want To Buy A Rattlesnake?

[*Continued from page 76*]

Fangs properly removed never grow back, and although the sacs are full of venom again within a short time the rattler has no way of ejecting it.

When, a few days later, the snake has entirely recovered from its operation it is ready for a zoo, snake act or circus. Telegrams come hourly—in fact so many that the farm has its own teletype for receiving orders—and snakes in special boxes go all over the world.

Although the Kings have shipped tens of thousands of rattlesnakes they have had only one major catastrophe. A telegram arrived one day a few years ago from a man with a snake act requesting "one den not fixed snakes." A "fixed" snake, of course, is one that has had its fangs removed. Consequently the snake man received a box of deadly rattlers instead of the defanged variety ordinarily used by snake men. Paying no attention to the warning notices on the box the fellow opened it and thrust in his hand to remove the reptiles. He was instantly bitten and died a few hours later.

The telegram he had sent read, "One den lot fixed snakes," but in transmitting the message the telegraph company had somehow changed the "l" to an "n." And that small mistake had cost a man his life.

In this instance the blame had to be borne by the telegraph company, but it bears out Snake King's home-made adage: "It doesn't pay to make mistakes—with rattlesnakes!"

Bug Catching Like Snipe Hunt

[*Continued from page 77*]

Although war dispatches from the front are closely guarded and censored, reporting spies have discovered that June beetles, for example, are heaviest in flight in May, June and July, and that the female bugs fly earlier in the evening than the males.

After lengthy experiments prove the effectiveness of certain light traps for a definite species of insect, lights of known density and intensity may then be installed on individual farms to concentrate and wipe out crop-swallowing swarms peculiar to each community.

If the air in a house is dry, it takes more fuel for heating, because a room is comfortable at five to eight degrees lower in moist air.

Average-sized tires on an automobile revolve 43,000 times an hour if the car is driven at 60-mile-an-hour speed.

One kind of artificial rubber in Germany is made of carbon and lime.

Knee Action Axle On Sugar-Cane Truck

This wierd juggernaut was designed and constructed in Seattle by local engineers to traverse the sugar cane fields in the Hawaiian Islands, to act as a sort of go-between from the canes to the mill railroad. The lumbering machine weighs 13,500 pounds when empty and can carry a four ton load of cane in a level load. It is powered with a 95 hp. 6 cylinder gas engine, and motivated by a chain drive. One man sitting in the cab can cruise along the rows of sugar cane, handle the loading of it into the huge tank on the back, and then drive to a waiting railway car and dump the load into the car.

Curiosity Killed This Octopus

When a man captures an octopus, that's news—good news for the museum he represents. Over a pickled six-foot specimen brought back from the Phoenix Islands in the South Seas, Dr. Leonard P. Schultz of the U. S. National Museum told how the big sea-squirmer's curiosity proved its undoing.

Dr. Schultz and an assistant were collecting with a big net, in water three or four feet deep, when a six-foot octopus slithered out from under a rock and swam slowly towards him, evidently attracted by his black and white tennis shoes.

"I stood still, hoping I could net the creature," said Dr. Schultz, "but my helper moved suddenly and it darted back. After a patient wait, its curiosity got the better of it and it came out again. It came closer and closer, and just as it seemed about to wrap its tentacles about the object of its interest—my shoes—I clapped the big net over it and succeeded in capturing it.

"When I looked up, my helper was far away up the beach."

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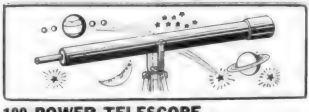

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"Ice Lizard"

[*Continued from page 91*]

The power-plant consists of a ½ h. p. utility gas engine such as can be taken off of washing-machines, or other home appliances. Any good ½-h. p. engine will do so long as it turns up 1,700 to 1,800 r. p. m. These have a kick-starter and the newest models are equipped with starter and battery for a small additional cost. This engine is belted to a reduction pulley and jack-shaft to which is fastened a 4-foot, 4-inch wooden air propeller with a 2-foot, 6-inch pitch.

First choose an oak block 12 inches long by 6 inches wide by 2 inches thick. To the top of this mount two ¾-inch pillow blocks as indicated and bore a hole in each corner for a ¾-inch pipe. Bend the four pieces of ¾-inch pipe in the shape indicated. The feet are threaded to floor flanges and the tops fit up in the corner holes in the oak block with lock-nuts above and below. The finished standard should bring the jack-shaft about 2 feet above the deck and its feet should spread to within a few inches of the sides of the deck. Front clearance of two or three inches should be allowed for the propeller from bow. Bolt the flanges to the deck and the propeller can then be fitted to the front end of the jack-shaft. The V pulleys, jack-shaft and V belting used can be purchased at any chain store selling the popular makes of homecraft power tools. As shown, ¾-inch shafting is specified throughout.

Bolt the engine to the deck, shimming it up if necessary to fit the belt over the engine and jack-shaft pulleys and then allow it to come back so pulley is reasonably taut before bolting home. As time stretches the belt this slack can be taken up by readjusting the jack-shaft block height by means of the supporting pipe lock-nuts. The engine speed control and switch (as well as electric starter controls in the late models) can be extended back to the driver's position and fastened in any convenient location. The exhaust should be led aft by a long flexible hose lashed to one side of the body.

If thought necessary, the builder can build a front and side screen wire protection for the propeller. While of low power, it might easily prove dangerous nevertheless and a screen hood would be an added safety factor. Even side, tail and head lights can be added with only a little additional wiring. Your starting battery can be used to provide the lighting power. Thus, night driving over the lake will provide its own thrills.

In starting the "Ice Lizard," jam the brake into the ice, start the engine and let it warm up. Then release the brake and the craft will pick up speed in a few seconds. Make wide turns and for quick stops cut the engine and jam the brake down hard.

Three or more "Ice Lizards" will provide plenty of ice sport this winter. Pepped-up engines, sharp runners and racing props might enable you to drive the old boat at fancy speed.

British Bombers Prove Worth In Battle

A group of Royal Air Force planes in echelon formation, ready to dive bomb. These two-seat bombers, which were not held in very high esteem before the present war started, have shown their worth in mixed battle with German planes over which they have demonstrated marked superiority. These planes are Fairey "Battles", powered with Rolls-Royce engines, and capable of a top speed of 257 m.p.h.

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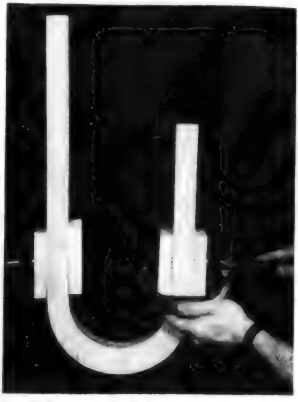
Modernistic End Table

[*Continued from page 99*]



Half-lap joints, well glued, are used where the straight sections meet the curved section of the table. Use small scraps of wood under the clamps to prevent the heads of the latter from marring the surfaces.

bottom of the stem curve. Again sand this assembly. The curved piece which supports the top is cut from a piece of 1¼" thick stock, 6" wide and 8" long. The outside radius is 6", inside 4¾". The tangent portion of this piece is 2".

Screw the small base piece to the stem and then screw the large base piece to the small one. Screw the piece B to the top of the short leg of the stem through a diagonally drilled hole in the stem. Level this piece and drill a ½" hole through the long leg of the stem and into the end of this piece. Into this hole insert and glue a ½" dowel and allow it to protrude about 1½". Now drill a ½" hole in the upper curved piece and glue this in place. Note that the small top piece is previously attached to the top of the long leg with a diagonally inserted screw.

Sand overall and stain the tops and base pieces. Shellac the stem section, and give a coat or two of brilliant aluminum paint. Then varnish the entire table.—*Ralph T. Moore.*

Cockroaches are fond of starch and will eat it off bookbindings and curtains.

Cotton is being grown farther north in the Soviet Union than anywhere else in the world.

Book Ends For A Man's Den

[*Continued from page 95*]

Copper Disc Book Ends: At first glance, these book ends appear to be two solid discs of copper nearly 1 inch thick, one lying flat, the other attached to it at right angles to rest vertically. From each vertical disc stands out, in silhouette, the outline of a horse's or dog's head. Any other appropriate outline can be used instead.

The discs are not solid copper; here's the trick of making them: Turn four hard maple discs 6 inches in diameter and ⅝-inch thick, with square edges. Turn a fifth disc of the same diameter of white pine. Get enough sheet copper in fairly heavy gauge to make four discs 8 inches in diameter and trim them carefully to size with tin snips or cold chisel.

Mount a maple disc on the face plate, bring up the back-up block centered on the dead center. Place a copper disc between them and then with spinning tools, or a rounded tool in the metal lathe, spin the protruding portion of the copper over until it lies flat on the edge of the maple disc. It will help immensely if the copper is annealed several times during this spinning. To anneal copper, heat it cherry red and then douse in cold water. If properly done the copper will become so soft that you can, in an emergency, do this spinning with the rounded, well-greased end of a maple dowel held in the hands. The surface should be kept lubricated at all times during the spinning. As the edge is spun, the metal is somewhat stretched, so you will have a bit of waste to cut off with a sharpened file tang when the spinning has been finished. Be sure the copper extends fully to the back surface of the maple so no wood will show.

Polish, at high speed, using the following abrasives on the copper in the order named: No. 0, No. 000 steel wool, powdered pumice or fine emery dust on an oily rag, rouge on an oily rag. The result will be a mirror-like finish. Wash this off with soda water, rinse, and dry; then give a quick, even coat of clear lacquer to prevent tarnishing.

When the four discs have been made, cut off a segment from each and mount them in pairs as shown with long wood screws turned up through the bottom discs into the uprights to hold them securely.

A dog or horse head is ideal for the silhouette. Make this from 1½ to 2 inches over all. Trace the outline on paper carefully, glue this to a half-inch white pine piece. Fit the thick copper between the wood and another similar piece below and fasten the three pieces together with screws or nails through the corners of the wood beyond the metal. Then with a metal cutting blade in the jig saw set at slow speed, jig out the head. Make both alike. Smooth the saw cuts with a fine file, then polish the pieces in the manner suggested above. Two prongs extending from the animal's

[*Continued on page 132*]

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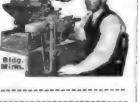

A FOLEY Automatic Saw Filer files hand, circular and band saws better than the best hand filer. Cash business, no canvassing, no experience. No education needed. Louis F. Wade-wick, Ohio, says, "I have filed 764 saws in spare time and have earned $850.00 in carpenter work due directly to my sawfiling contacts." Send coupon for FREE PLAN, no obligation.
FOLEY MFG. CO., 217-40 Foley Bldg., Minneapolis, Minn.
Send Free Plan on Saw Filing business.
Name _____
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Book Ends For A Man's Den

[*Continued from page* 131]

neck are then passed through holes made for them in the upright discs and the heads set in place. They should be slightly above center. Bend the protruding ends of the copper prongs over on the back side. If you wish, these prongs may be omitted and the heads soldered onto the upright discs. If this is done, then both heads and discs must be cleaned and lacquered after the soldering operation.

To finish the book ends, cover bottom and back sides of the discs with felt glued on. No leading of the pieces will be necessary, since the weight of the copper plus that of the hard maple will be sufficient to hold them firmly in place.

Mount Vernon Playhouse

[*Continued from page* 89]

are purely decorative and may be dispensed with. Building problems are reduced to simplest terms by the use of outdoor plywood, which will not deteriorate under any weathering condition, and thus can be used on roof as well as sides, each being cut in a single panel. The standard widths of 48 in. fit exactly in each case.

To gain additional height, a 10 in. baseboard is carried all around on the outside, and if individual needs demand greater height, simply add another baseboard. For a playhouse only, no baseboard will be needed for children under seven years. To divide into two rooms, a half-partition about 30 in. high is suggested. The original Mount Vernon is painted white with a red roof; the same color scheme fits in with this playhouse. On plywood, however, do not use a quick-drying paint or enamel.—*Hi Sibley.*

Lead Skate Sheath

[*Continued from page* 92]

them sharp and free from nicks. Get a small sheet of the lead from a plumber or hardware store and cut two strips 2 inches wide and as long as the runners. Cut away portions of each side to form triangular prongs as shown. Then fold the lead lengthwise in the center. You now have only to slip one of these over your skate runner and bend the tabs over the top of the runner to lock them in place as shown in the lower sketch.

If you have some black lacquer handy paint the sheaths before using them, although lead itself will not rust. By rubbing a small amount of heavy oil on the inside surface of each sheath, a bit of this will be transmitted to the runners and thus tend to keep them free from rust.

New Teeth For The Dogs Of War

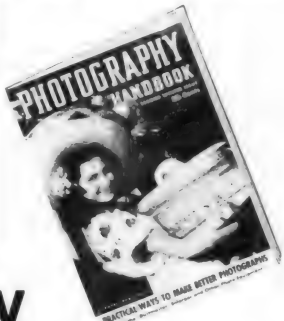
The days when the cavalry charged into action with flashing sabers has passed away with the formation of the new streamlined First Cavalry Division, at Fort Bliss, El Paso, Texas, and commanded by Major General Kenyon A. Joyce. When the mounted troopers ride into action they are armed with the .45 cal. automatic pistol, some also carry the .30 cal. rifle, some carry the .30 cal. automatic rifle, others carry the .45 cal. sub-machine gun. Other weapons of this new streamlined cavalry include the .30 and .50 cal. machine guns, which are carried by pack horses, a complete machine gun being carried by one pack animal led by a mounted trooper. The photo above shows weapons being inspected by Lieut. G. F. Powell. Front to rear right, two of each type are shown; .30 cal. machine gun air cooled; .30 cal. machine gun, water cooled; .50 cal. machine gun; 37 mm. gun; 75 mm. howitzer. Front to rear left: .45 cal. automatic; .45 cal. sub-machine gun; .30 cal. rifle; .30 cal. automatic rifle.

Ice Tops

[*Continued from page 92*]

length of stout cord around the top, beginning near the bottom, until the sides are wrapped. A smooth jerk will set it spinning on the ice. The spindle top is spun with the fingers. Draw a circle 6 feet in diameter on the ice, and let two or three persons spin their tops at the same time. If two tops leave the circle, the owner of the remaining top wins one point. If all the tops remain in the circle, the top which stops last gets the point. Play "Ice Tops" up to a game of 15 points. Painted in bright colors, or decorated with contrasting stripes of color, they look very attractive.

GOOD NEWS FOR PHOTO FANS!



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N.A.C.A. Laboratories Seek 600-Mile-An-Hour Airplane

Just in case you do not believe this is a speed-mad age, come down to a unique aeronautical laboratory at Langley Field, Va., where the world is in a 600-mile-an-hour whirl.

You may wonder at the wisdom of going so fast, but it's exciting and breathtaking anyway—even to the skeptic who doesn't want to go from New York to Los Angeles in four and a half hours. It's 19 wind tunnels, a dozen laboratories. It's 200 engineers and almost as many research projects driving ever harder at catching up with the speed of sound.

As transatlantic cables flash word of new speed records and of military planes in Europe so fast they can almost race a rifle bullet, Langley Memorial Aeronautical Laboratory, Uncle Sam's little known air research center, is turning more and more of its attention to extreme high speed flight. Its engineers are verbally tossing hundreds of miles an hour around as never before.

The wing for a 500-mile-an-hour airplane, which will probably make its debut within two years, has already been born here. Still more startling developments of a similar nature are on their way.

From the laboratory, operated by the National Advisory Committee for Aeronautics, have come in the past hundreds of developments that have boosted airplane speeds to their present level, and with them have come means for making airplanes safer and more reliable. But the public will be hearing less of the latter phases of the Committee's activities in the next few months as an air force expansion program preempts the attention of Langley Field scientists. They, more than anyone else in the United States, must see to it that this air force is based on knowledge that will make it better than any other in the world.

A few years ago the famous N. A. C. A. cowling, to fit around projecting cylinders of air-cooled radial engines, was perfectly satisfactory for all existing planes. But within the last year the trend toward higher speeds has forced the laboratory scientists to re-do the earlier job and produce a cowling suited for the speediest Army pursuit ships fitted with radial power plants.

Exact studies of costly flush riveting have been worked out also, so that designers in the great aircraft plants may know how much additional speed can be gained. The speed-seeking N. A. C. A. scientists have even investigated the effect of seemingly slight surface irregularities on wings and found that smoothing them out adds to speed. The effects of different kinds of coating—bare, lacquered, painted—have also been studied with this same end in mind: hatching in five or six years' time the 600-mile-an-hour airplane. Because, even if a ten-mile-a-minute clip seems a little fast to you and me, it isn't to the men piloting America's national defense on the Front Aloft.

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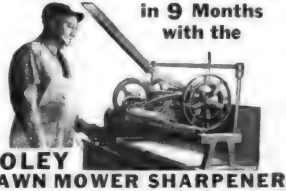

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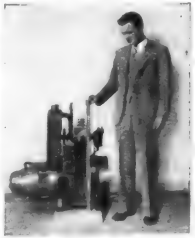

This tiny diesel engine operates small machines economically, using only 0.48 pounds of fuel per horsepower per hour. The fire hazard is eliminated, due to the low point of combustion of the fuel.

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Army Tells Method Of Making Charcoal For Gas Masks

The Army's method of making superior activated charcoal for gas masks out of ordinary wood—a process for the last ten years kept a military secret of the United States—has at last been made public by the issuance of Patent No. 2,162,366 to Major Maurice E. Barker and Chemist Robert S. Brown of the Chemical Warfare Service.

Activated charcoal is the agent in gas masks which absorbs poison gases and filters them from the air. During the World War coconut shells provided much of the raw material for such charcoal but the demands were so great that nation-wide collections were made of peach pits, as many will recall.

By the new Army method America's vast supplies of wood—any wood—can be turned into highly absorptive charcoal granules that will fill gas mask canisters for soldiers and civilians in the next war.

The invention of the Chemical Warfare Service experts, now disclosed, takes two-inch cubes of dried wood, dehydrates them with chemicals, dries them again and finally compresses them under pressures of from 10,000 to 20,000 pounds to the square inch.

The blocks, made dense by the severe squeezing, are then charred at relatively low temperatures in air for 24 hours and then placed in an atmosphere of carbon dioxide and heated slowly to temperatures of 1,472 degrees Fahrenheit. Finally the charcoal cubes are cooled in a carbon dioxide vapor. When finished they are ground into coarse granules ready for use in gas masks.

The gas retention of this special charcoal is about double that obtained by any methods previously known, states the patent.

From the military point of view, explains the Chemical Warfare Service, a charcoal for gas masks must be very, very dense and yet retain the largest possible volume of gas. Ordinary charcoal could be used in gas masks but it might be necessary to carry a bushel of it around to get the necessary effect. The Army's charcoal, in contrast, gets an equal effect with a very small volume.

England, in her present hurry to create gas masks for all her civilians as well as her armed forces, makes her charcoal out of a combination of peat, lignite and coal which is ground and carbonized with heat. It is then mixed with a binder material, compressed, and run through dies from which it emerges as long spaghetti-shaped strips that are sliced up into granules for the masks.

The commercial art of making charcoal is gradually approaching the methods long used by the Chemical Warfare Service, so that it has been decided to make the long-secret patent public property.

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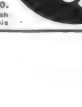

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Only a small portion of the present traffic on American highways could be attracted to these super-systems, states a report prepared by government experts on highways.

Transcontinental tourists would certainly like the roads, it is agreed, but how many such tourists do you think are travelling daily on an average basis? Take a guess.

Counts made on east-west highways at checking stations established from Canada to Mexico show that only 300 passenger vehicles crossed this north-south line daily in transcontinental travel.

The upkeep of super-highways would be based on tolls which have been estimated to be about one cent per vehicle mile for passenger cars and 3.5 cents a mile for trucks and busses.

However, on a cost basis, the Bureau of Public Roads finds that estimated tolls for the six super-roadways planned would come out to be about $100,000,000 less each year than the estimated cost of maintaining them. The building cost for the total of 14,336 miles of super-highways would be nearly three billion dollars.

Only on one stretch of the proposed highways would conditions appear to be self-supporting. This is the 172-mile highway which would link Philadelphia, Pa., and New Haven, Conn., and tap a dense population area. By 1960 this section of super-highway might break even.

Face Plate Vise

[*Continued from page 97*]

assurance that when the vise is mounted, the solid jaw will be correctly aligned. To mount the vise, disregard the regular mounting holes. Bore and tap two new bolt holes in line with vise screw. One of these should be as far forward on the base as possible and the other back on the ways, a distance equal to the distance between the face plate slot center lines, to give maximum adjustment. A spacer washer will probably be needed for the back bolt. In use the stock is lined up to center boring operations by adjusting the vise in the slots in one direction and by moving the stock in the jaws in the other direction. For facing, it is only necessary to place it in the jaws roughly centered. The bar used for tightening the vise has one of the balls ground off one end, so that it can be removed before the lathe is started.—*K. W. R.*

This Skirt Should Be Pressed With Steam

Here's a new skirt capable of turning either the eye or an 80,000 kilowatt turbine. The pretty girl is shown wearing $5,000 worth of General Electric turbine buckets. Though a bit impractical as skirt material, these steel buckets, also known as blades, are important parts of huge electricity producing equipment. They function like the blades of a windmill in harnessing energy of scorching steam shot through some turbines at 1,200 miles an hour speed, 12 times greater than that of the average hurricane.

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Earthquakes that originate as deep in the earth as 400 miles have been recorded.

Two-Toned Bracelet

[*Continued from page* 103]

hole, and dip the blocks one at a time and wipe off the drop which forms on the lower corner. Varnish can be used, but clear lacquer will be better.

Finally, thread the elastic through each row of holes and knot it between the blocks with the enlarged holes and trim the knot so it will disappear in the holes when released.

Plastic is used in the same way and many lovely color combinations are possible. You also have a wide choice of wood combinations. Here are some: mahogany and box elder; red cedar and figured gum; figured gum and sap gum; ebony and holly; osage orange and white pine. You will be able to work others easily.—*D. R. Van Horn.*

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"Liquid Coal" Demonstrated As Fuel For Automobiles

Foreshadowing a time when man's immense coal resources, which far outstrip other sources of power available at present, may be put to work in the automobile in place of gasoline, a stock car changed only in one minor respect made a first demonstration run in Chicago on a new fuel, "liquid coal."

Made of finely pulverized coal suspended in an oil "carrier," the new fuel, whose development has attracted the attention of scientists and engineers during the last twenty years, has enabled the car, an eight-cylinder 1939 sedan, to accelerate up to 35 miles an hour within a block.

Applied to a standard automobile by Dr. Francis W. Godwin, director of the coal research division of the Armour Institute of Technology's research foundation, the fuel is more economical than gasoline although the cost per gallon is about the same, because it contains far more energy.

Neither the carburetor nor the ignition system of the car was changed in any way. One fine-screened filter was removed from the fuel system to accommodate the colloidal fuel, Dr. Godwin said.

Because coal itself is essentially inconvenient to handle and bulky, scientists have been trying to devise a workable "liquid coal" such as this for many years. Thus far, however, it was stated in Washington, all such fuels have been impossible to use economically in an internal combustion engine because of the ash which coal leaves and which causes great wear and tear on the moving parts of the engine. It is not known whether the new development has overcome this difficulty.

"Three different types of liquid coal have been successfully used in the tests on the stock model automobile," Dr. Godwin said. The first was a suspension of a specially prepared coal ground to 300 mesh in a mixture of gasoline, fuel oil and lubricating oil. The second was a similar suspension of the coal in a Diesel oil. The third test was made with a very light oil. In each case, the liquid coal was chemically stabilized to hold the coal in suspension.

Photo Uses For Radio Parts

[*Continued from page* 113]

secondary to light two or three dial bulbs in dark corners. All you'll need is as many miniature lamp sockets and common bell wire. By putting a radio switch into each lamp line you have control at your fingertips. Stain the bulbs red with any good lamp stain or even finger-nail polish.

Another use for pilot bulbs is as a wand-light for searching dark corners and high shelves. Attach a socket to a long stick, as in Fig. 6, and wire down to a switch on the handle and to a suitable voltage source by a plug. Bulbs can be left plain or stained as needed.—*L. B. Robbins.*

Cold Ice Puts Out Hot Gasoline Fire

"Dry ice," the stuff that keeps your ice cream from melting and makes your soft drinks fizz, is also a highly effective fire extinguisher, as the picture above indicates. In a demonstration recently held in New York, gasoline was allowed to pour down the side of a ten-foot wall, and then ignited. Using a new type extinguisher with a horn-like spout, a man dressed in ordinary clothing then advanced directly into the flames and put them out in a few seconds.

The gas in the cylinder actually is carbon dioxide, imprisoned under high pressure. When released, it solidifies into very fine particles resembling snow.

When laminated glass was first patented in England in 1885, the idea was not safety but the decorative feature of colored glass between clear sheets.

It is harder to see a blonde out of the corner of the eye than a brunette, especially if the blonde wears red and the brunette black and white, says the Better Vision Institute, explaining that colored objects far to the side are less easily perceived than black and white.

Diesel trucks consume 30 to 50 per cent less fuel than gasoline powered trucks.

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Multiplying and dividing can be done in rapid time with a simple computing device, which has two scales on endless tapes so that they can be turned separately or as a unit.

A hollow aluminum life preserver which weighs four and a half pounds will support three persons. Nineteen inches in diameter and five inches thick, it will last indefinitely. It can easily be thrown a distance of fifty feet.

For rip or cross-cut sawing, beveling, dadoing, tenoning and shaping there is a small, electric, wood-working machine. It can be mounted on a floor stand or on a light trailer.

For rural or suburban sections there is a combination range with two ovens, one electric and the other heated by coal or wood. The electric oven is intended for summer use and the other one to help heat in cold weather. Both can be used at once, if desired.

A new egg beater has a wide grip which enables the housewife to take a firm hold. The drive crank can be turned at high speeds with less than the usual exertion because of the stability given the unit by this extra gripping surface. The drive wheels and gearing are enclosed in bakelite housing, thus preventing corrosion and simplifying cleaning of the beater.

For general building construction, sealing conduits, tile setting, glazing and other purposes there is a sealing and caulking compound that is permanently plastic, waterproof and unaffected by vibration, vermin or severe weather.

Plastic hooks for shower curtains will not rust or break. Available in a full range of colors, they are easily slipped on rod or curtain and will not come off by accident.

With a new lettering set which is fast and versatile it is possible with a single guide to produce eight different types of lettering by changing the setting of the tracer and pen arm. Each guide has upper and lower case letters, numerals and characters.

A 14-ounce bag of specially treated paper and charcoal, which ignites at the touch of a match or lighted cigarette, eliminates the need for kindling to start the furnace. You put the bag on the furnace grate, light it, pour coal on top, and almost at once you have a roaring fire.

A semi-automatic tying device quickly ties bundles and boxes with wire. After the wire is draped around the bundle or carton, the mechanism tensions, ties and cuts the wire and rethreads for the next tie. The same adjustments handle different sizes.

A focusing spotlight, working with a flash gun apparatus and using the same batteries, is available for taking flash photos when the light is not sufficient for focusing.

A rare clay, specially treated, will seal dams, ponds and ditches which have excessive leakage or seepage. When spread over the surface it eliminates most of the seepage.

More room in the medicine closet or on the shelf is afforded by these wide flat caps which enable a tube to be stood on its end until entirely consumed. Caps are made of bakelite in a wide range of sizes for all types of collapsible tubes.